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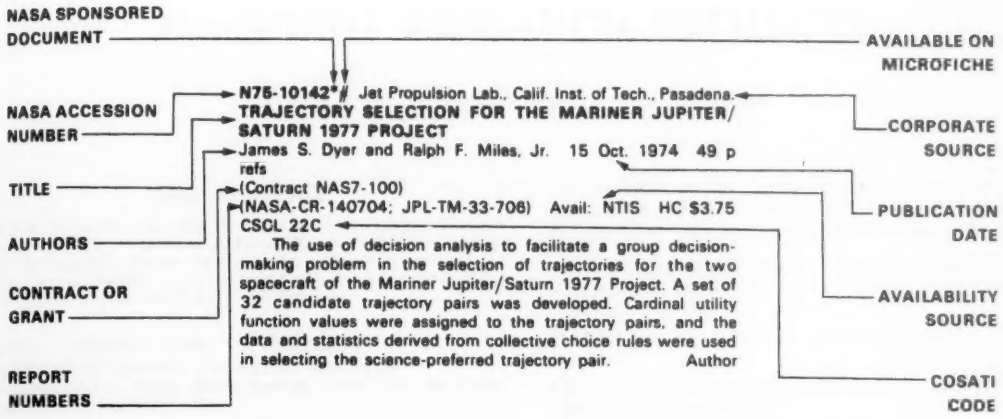
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James S. Dyer and Ralph F. Miles, Jr. 15 Oct. 1974 49 p refs
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The use of decision analysis to facilitate a group decision-making problem in the selection of trajectories for the two spacecraft of the Mariner Jupiter/Saturn 1977 Project. A set of 32 candidate trajectory pairs was developed. Cardinal utility function values were assigned to the trajectory pairs, and the data and statistics derived from collective choice rules were used in selecting the science-preferred trajectory pair. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects— not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AERODYNAMIC ENVIRONMENT OF HELICOPTER/GROUND LAUNCHED MISSILES
B. JENKINS, U.S. Army, Missile Systems Laboratory, *Huntsville, Alabama* 35809 (DA0E1109)

To define the direction and velocity at points in the airstream about a helicopter in hover and forward flight sufficiently that the flow environment encountered by missiles launched from the helicopter may be determined.

Flight tests for a variety of situations will be conducted measuring the desired properties in the regions of interest.

Supporting agency address information: MICOM Aeroballistic Directorate, Redstone Arsenal, Al 35809

SUPPORTED BY U.S. Dept. of Defense - Army

1.0002, HELICOPTER TROOP SEAT RESTRAINT SYSTEM DESIGN CRITERIA EVALUATION
S. DESJARDINS, Dynamic Science Corporation, *Phoenix, Arizona* 85027 (DA0D3855; DAAJ02-73-C-0077)

The objective is: (1) to analytically and experimentally evaluate the practicality, operational suitability, and crashworthiness of the troop restraint system design concepts generated under contract DAAJ02- 72-C-0077; and (2) to update a proposed draft military specification, 'Restraint System, Aircraft Troop/Passenger,' for subsequent coordination and publication. This effort is a part of the Army's crash survivability program to develop design criteria and hardware to minimize injuries during aircraft crashes.

The two restraint system concepts designed during DAA402-72-C-0077 shall be analyzed relative to crashworthiness, practicality, and operational suitability. Commercially available restraint system components will be investigated and detail design of the two concepts will be performed. Static test articles will be fabricated and tested per the draft military specification. Based on test data analysis the two designs will be refined and the proposed draft military specification updated.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0003, HELICOPTER TROOP RESTRAINT SYSTEM DYNAMIC TESTING AND EVALUATION
S. DESJARDINS, Ultrasystems Incorporated, *Phoenix, Arizona* 85027 (DA0D3927; DAAJ02-74-C-0034)

(1) Fabricate, dynamically test, and evaluate the two troop restraint systems previously designed and statically tested under contract DAAJ02-73-C-0077, and (2) recommend modifications to the proposed draft general military specification entitled MIL-S-XXXX(AV), 'Restraint System, Aircraft Troop/Passenger,' and USAAMRDL TR 71-22, 'Crash Survival Design Guide'.

This effort will be performed in three (3) tasks- Task I, restraint system dynamic testing- Task II, fabrication and delivery of Type II restraint systems- and Task III, design criteria finalization.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0004, ADVANCED DE-ICING CAPABILITY FOR ARMY ROTARY WING AIRCRAFT
J.B. WERNER, Lockheed Aircraft Corporation, *Burbank, California* 91503 (DA0D3877; DAAJ02-73-C-0107)

The objectives of this program are to establish icing severity levels against which future Army helicopter ice protection system should be designed and to advance helicopter ice protection technology.

The probability of various icing severity levels will be established along with ice protection state-of-the-art. Future Army aircraft missions will be evaluated to establish probability of icing encounters. Trade-off analyses will be performed using various icing severity levels, various ice protection techniques for various aircraft types and missions, to establish optimized ice protection system design requirements. The effort will include design and test development of an optimum ice protection system for the UH-1H helicopter for test and evaluation. Analysis and documentation of program results will be performed for publication.

Supporting agency address information: AVSCOM Air Mobility R&D Lab, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0005, VHF/FM PRECISION HOVER
C. INSKEEP, Communications Components Corp, *Costa Mesa, California* 94527 (DA0D2802; DAAB07-74-C-0523)

The objective of this program is to develop a VHF/FM precision hover system that will give Army aircraft the ability to locate and accurately maintain position over ground based troops equipped with standard VHF/FM transceivers. The information displayed by the precision hover system would be used to locate ground-based troops for purposes of logistics support, personnel deployment, tactical air support and medical evacuations.

Maximum use will be made of the airborne FM receiver to provide the precision hover function. A small antenna assembly consisting of an antenna array and the appropriate electronic circuits would comprise the precision hover system.

Supporting agency address information: ECOM Avionics Laboratory, US Army Electronics Command, Fort Monmouth, NJ 07703

SUPPORTED BY U.S. Dept. of Defense - Army

1.0006, CALCULATION OF AIRCRAFT RADAR CROSS SECTION (RCS)
S. LOCUS, Northrop Corporation, *Hawthorne, California* 90250 (DA0D3954; DAAJ02-75-C-0002)

Basic contractual effort is to develop a computational procedure capable of predicting the radar cross section of US Army helicopters. This program will be used as a tool in the design of new or improved helicopters to reduce their detectabili-

ty on the battlefield. Provisions will be made in the program to evaluate radar signature reduction features prior to a costly development effort.

This effort is intended to utilize the past work of the Air Force, which was directed at fixed wing aircraft, by modifying or developing new procedures to cover helicopters. Initial work will be for a reflecting surface only.

Supporting agency address information: AVSCOM Air Mobility R and D Lab, Eustis Directorate, Fort Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0007, FAILURE PROGNOSIS OF ROTARY WING AIRCRAFT MECHANICAL COMPONENTS

J. REIS, Northrop Corporation, *Hawthorne*, *California* 90250 (DA0C4110; DAAJ02-72-C-0118)

The objective of this program is to obtain and analyze data on the relationship of specific sensory outputs to a helicopter gearbox's condition and to investigate their applicability on the determination of the remaining useful life of the component.

Conduct mechanical component tests using at least three government- furnished UH-1 series 90 degrees gearboxes including one high-time gearbox in a known serviceable condition and two gearboxes containing a known incipient failure--one gearbox will contain a gear in incipient failure condition, and a second gearbox with a bearing containing an incipient failure.

Supporting agency address information: AVSCOM Air Mobility R&D Lab, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0008, INVESTIGATION OF BRITTLE FRACTURE IN GRAPHITE EPOXY COMPOSITES, ARMY AIRCRAFT STRUCTURES

L.B. GRESZCZUK, McDonnell Douglas Astron. Co., *Huntington Beach*, *California* 92647 (DA0D3892; DAAJ02-74-C-0009)

To identify and characterize the impact brittle fracture mechanism experienced by graphite-epoxy composites when subjected to foreign object impact tests. Determine material variables (i.e., fiber properties, fiber orientation, laminae stacking sequence, matrix material, thickness, curvature, interleaving a second material) which affect the brittle fracture mechanism of composite structures and the resultant effect on structural qualities. Develop a computer program for evaluation of impact behavior of composite designs. Improved impact resistance of graphite-epoxy composites is needed to allow their use in Army aircraft structures.

Modify an existing computer program to allow evaluation of composites with laminae at varying angles and to account for curvature. Use computer analysis to develop less brittle composites and verify analysis with a test program.

Supporting agency address information: AVSCOM Air Mobility R D Lab, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0009, FEASIBILITY OF UTILIZING SIMULATED HUB FORCED VIBRATIONS IN HELICOPTER RELIABILITY TESTING

F.D. BARTLETT, Kaman Aerospace Corporation, *Bloomfield*, *Connecticut* 06002 (DA0D3971; DAAJ02-75-C-0004)

Determine feasibility of using ground tests to duplicate in-flight vibratory loads, structural responses, and stresses to provide a relatively low-cost early means of detecting problems and assessing corrective redesigns early in a helicopter systems development phase.

Under prior contracts a structural dynamic test method for determining the equations of motion of a simple structure was developed and experimentally verified. Further demonstration through application of the method to a full-scale helicopter is planned by this Directorate. More recently, Kaman Aerospace has extended the theory, devising a method for determining rotor hub loads (forces and moments) directly from measured fuselage accelerations. Presently, there is no generally effective method for measuring hub loads. Results of this first phase will verify the extended theory and establish its engineering practicality, evaluating calibration procedures, data collection, and data handling techniques, effects of measurement error, and the sensitivity to changes such as gross weight.

Supporting agency address information: AVSCOM Eustis Directorate, US Army Air Mobility Research Development Laboratory, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0010, HELICOPTER TRANSMISSION VIBRATION AND NOISE REDUCTION PROGRAM

R. BOSSLER, Kaman Aerospace Corporation, *Bloomfield*, *Connecticut* 06002 (DA0D3929; DAAJ02-74-C-0039)

To generate clear, concise, and usable analytical tools that would, during the design stage of a program, allow the design team the capability to perform trade studies that would yield drive train components that are dynamically quiet, with inherently longer life and reduced vibration and attendant noise levels.

(1) Construct analytical prediction technique and predict vibration/noise levels of baseline test transmission; (2) Test baseline transmission; (3) Refine analysis/design and fabricate components to reduce vibration/noise levels of baseline transmission; (4) Test modified transmission; (5) Compare results and conduct users' conference.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0011, EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF THE CONTROLLABLE TWIST ROTOR (CTR SYSTEM)

A.L. LEMNOIS, Kaman Aerospace Corporation, *Bloomfield*, *Connecticut* 06002 (DA0C4093; DAAJ02-72-C-0092)

The technical objective of the program is to experimentally evaluate the potential aeroelastic and performance benefits of the controllable twist rotor (CTR). The CTR is a rotor concept which uses torsionally soft blades in conjunction with a mechanical blade root control and aerodynamic blade tip control to produce blade twist control.

The CTR concept will be carefully analyzed and a FU66 model system will be designed and built. This model, which will be approximately the size of a CH-34 rotor system will be tested on the Kaman whirl tower to establish basic stability and performance. The model will then be shipped to NASA-Ames where it will be tested in the 40 by 80 foot tunnel. The results will be carefully evaluated to determine the aeroelastic and performance characteristics of the CTR versus more conventional systems.

Supporting agency address information: AVSCOM Air Mobility R and D Lab, Eustis Directorate, Fort Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0012, FAILSAFE COMPOSITE ROTORHUB CONCEPT

R. MAYERJAK, Kaman Corporation, *Bloomfield*, *Connecticut* 06002 (DA0D3976; DAAJ02-75-C-0013)

Fiber reinforced composited materials have demonstrated their applicability in high-performance aircraft structures such as helicopter rotor blades, wings, rudders and sections of fuselage. The feasibility of fabricating a helicopter main rotor hub using composite materials has been demonstrated under contract with Whittaker Corporation, Research and Development Division. The objective of this program is to develop improved low-cost failsafe rotor hub technology. The use of composite materials can both reduce initial cost and provide a failsafe structure at no increase in weight.

Evaluate new hub concepts for low cost, low weight, ballistic resistance, radar reflectivity, and reliability and maintainability aspects. The better concept will be selected for further development which will include material and subcomponent fabrication and testing. After analysis of the test results, the hub design will be updated.

Supporting agency address information: AVSCOM Air Mobility Research and Development Lab, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0013, HOVER AND FORWARD FLIGHT ROTOR WAKE ANALYSIS FOR THE ROTORCRAFT FLIGHT SIMULATION
A.J. LANDGREBE, United Aircraft Corporation, *Hartford, Connecticut* 06118 (DA0D3913; DAAJ02-74-C-0027)

To improve the capability of the rotorcraft flight simulation program to predict the performance, stability and control, and rotor loads characteristics of present and future Army aircraft in hover and in forward flight.

A simplified rotor wake analysis will be developed which will predict the induced velocity field from main and tail rotors at any point in space. This analysis will be incorporated in the rotorcraft flight simulation program to account for rotor inflow as well as rotor- rotor and rotor-aerodynamic component interference effects. The mathematical model will provide a unified wake treatment for hover and level steady flight while remaining within reasonable cost/computer time limitations for program production use.

Supporting agency address information: AVSCOM Air Mobility R D Lab, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0014, INVESTIGATION OF FACTORS CONTROLLING ENGINE SCHEDULED OVERHAUL INTERVALS
P.A. KING, Avco Corporation, *Stratford, Connecticut* 06497 (DA0D3980; DAAJ02-75-C-0018)

Perform a detailed review and analysis of all applicable technical factors affecting the establishment and growth of scheduled overhaul intervals of aircraft turbine engines to determine the engine design, test and airframe integration requirements essential to achieve a significant increase in initial TBO's and TBO growth rates. The results will provide a basis for TBO control of current and future Army turbine engines.

Review past turbo-shaft engine reliability behavior, design margins, fault warning and developmental testing to establish causal factors for low, or limited, scheduled overhaul intervals. Upon assessment of degree of responsibility of each causal factor, criteria and recommendations are to be generated which would lead to high initial TBO's and rapid TBO growth for future engine programs.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0015, VALIDATION OF ROTORCRAFT SIMULATION PROGRAM THROUGH CORRELATION WITH FLIGHT DATA (ARTICULATED)
R. CARLSON, Sikorsky Aircraft, *Stratford, Connecticut* 06602 (DA0D3938; DAAJ02-74-C-0046)

The purpose of this program is to provide an independent evaluation of the C-81 rotorcraft simulation computer program (written by Bell Helicopter Company) through the comparison of selected flight test and full-scale rotor whirl stand test data with that calculated by the C-81 rotorcraft analysis.

Sikorsky shall review and compile unrestricted rotor test data for the CH-53 and S-67 Blackhawk Helicopters for comparison with analytical results to be obtained using the C-81 analysis. The contractor shall compile test data to exercise and compare the three major portions of the C-81, i.e., trim, stability and control, and maneuver. The major prediction effort shall be directed within the normal flight envelope of the subject helicopter with representative data points, approaching and on the flight boundaries.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0016, AEROELASTIC ROTOR STABILITY ANALYSIS
R.G. CARLSON, Sikorsky Aircraft, *Stratford, Connecticut* 06602 (DA0D3893; DAAJ02-74-C-0010)

The objective of this program is to produce a practical analytical tool which will evaluate the inherent aeroelastic stability of a specific rotor system.

An analysis will be developed and a computer program written to directly determine the characteristic values of the dynamic equations of motion of a helicopter rotor system. The equations would include coupling with rotor control system and would be applicable for hovering as well as forward flight conditions up to an advance ratio of 9k. Emphasis will be placed on a computer analysis which can rapidly and directly produce rotor damping ratios and time-dependent amplitude decay rates which can be rapidly evaluated to determine rotor stability.

Supporting agency address information: Avscom Air Mobility R D Lab, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0017, YUH-60A OPERATIONAL STATISTICS
R. CASERIA, Sikorsky Aircraft, *Stratford, Connecticut* 06602 (DA0D3975; DAAJ02-75-C-0003)

Evaluate the YUH-60A UTTAS helicopter under various reliability, operational and maintenance assumptions in both the R M and ARMS models.

The UTTAS operational scenario will be simulated with the UH-1N/R M model. The YUH-60A UTTAS Helicopter using 'mature' R M data will be simulated with the R M model (YUH-60A/R M) using the UTTAS operational scenario. The YUH-60A UTTAS helicopter will be input in the ARMS (Aircraft Reliability and Maintainability Simulation) model with a detailed operational, resource, and logistics scenario.

Supporting agency address information: AVSCOM Eustis Directorate, Air Mobility Research and Development Laboratory, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0018, DEVELOPMENT OF DESIGN, TEST AND ACCEPTANCE CRITERIA FOR HELICOPTER TRANSPARENT ENCLOSURES
B.F. KAY, Sikorsky Aircraft, *Stratford, Connecticut* 06602 (DA0D3955; DAAJ02-74-C-0065)

The development of design, test and acceptance criteria for helicopter transparent enclosures which will meet the mission requirements for present and future Army helicopters. The criteria to be developed will: (1) establish trade-off factors for determining optimum transparency performance characteristics; (2) provide a method for the Army to specify the relative importance of measurable transparency performance characteristics according to vehicle class/type or mission; and (3) prescribe those tests which will effectively ascertain whether or not a particular transparency has satisfied the intended performance characteristics.

It is intended to: (1) review prior studied, consolidate findings and prepare a draft specification in terms of measurable transparency performance characteristics; (2) develop viable acceptance tests; and (3) develop a design guide/criteria providing an assessment of the state-of-the-art. Primary emphasis under this contract will be devoted to; (1) structural integrity, including the interactive effects of airframe stiffness, edge attachments, structural loads, thermal variations, vibration, and windshield manufacturing tolerance based on induced loads resulting from windshield/airframe contour mismatch; and (2) development of a meaningful abrasion test.

Supporting agency address information: AVSCOM Air Mobility R D Lab, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0019, ADVANCED OVERRUNNING CLUTCH PROGRAM, ARMY AIRCRAFT
J. KISH, Sikorsky Aircraft, *Stratford, Connecticut* 06602 (DA0D3920; DAAJ02-74-C-0028)

This program consists of the investigation of helicopter overrunning clutch concepts with the objective of providing technology necessary to design clutches characterized by improvements in performance, weight, and reduced developmental and unit cost, while maintaining very high reliability and maintainability.

The program is a four (4) phase program outlined as follows: Phase I and II - the work consists of an analytical investigation and

preliminary design of proposed clutches and outlining an analytical design tool for later verification. Phase III - selected clutches will be detail designed in conjunction with formulation of detail analytical design tool. A test program shall be developed with the objective of validating the analytical design tool. Phase IV - specific clutch configurations shall be fabricated and tested. All test data will be analyzed to substantiate the analytical design tool and identify possible design deficiencies. All design deficiencies will be corrected via redesign with follow-on verification test. A product of this program will be a design guide for aircraft clutches.

Supporting agency address information: AVSCOM Air Mobility R and D Lab, Eustis Directorate, Fort Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0020, ENGINE/TRANSMISSION/AIRFRAME ADVANCED INTEGRATION TECHNIQUES
M. POTASH, Sikorsky Aircraft, *Stratford, Connecticut* 06602 (DA0D3949; DAAJ02-74-C-0042)

To identify innovative engine/transmission/airframe concepts which provide total airflow and power management to meet projected requirements of future Army aircraft, with minimum effect on vehicle performance.

Phase I- concept formulation - design baseline advanced aircraft subsystems using government-furnished guidelines. Phase II- concept selection - conduct trade-off analyses at the total systems level to aid in concept evaluation and selection. Phase III- concept evaluation - comparative analyses of two (2) aircraft (with and without IR suppression).

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0021, ADVANCED HELICOPTER STRUCTURAL DESIGN INVESTIGATION
M.J. RICH, Sikorsky Aircraft, *Stratford, Connecticut* 06602 (DA0D3952; DAAJ02-74-C-0061)

To define advanced structural configurations, utilizing the latest analytical, material and fabrication technology to satisfy requirements of structural efficiency, fail safety, safety and producibility/cost, for a helicopter of the 7000-9000 gross weight class.

Technical approach to the program will be in accordance with the following tasks: a. Task I - develop a preliminary design of a baseline aircraft (conventional structure) and preliminary design of aircraft incorporating various advanced structlral concepts. B. Task II - conduct weight, cost, and safety analysis of selected designs. C. Task III - conduct advanced aircraft design and baseline (conventional) aircraft comparison with respect to weight, performance, size, cost, etc. D. Task IV - conduct risk/feasibility assessment of the selected design concepts and identify supporting research efforts for highest technology risk areas. E. Task V - free-planet application study.

Supporting agency address information: AVSCOM Eustis Directorate, US Army Air Mobility Research and Development Laboratory, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0022, ADVANCED TECHNOLOGY COUPLINGS (MODIFIED MISALIGNMENT COUPLINGS) FOR HELICOPTER TRANSMISSION SYSTEMS
R.A. STONE, Sikorsky Aircraft, *Stratford, Connecticut* 06602 (DA0D3940; DAAJ02-74-C-0054)

This program will consist of the investigation of new as well as current helicopter coupling concepts with the overall objective of providing the technology necessary to design couplings characterized by improvements in performance (i.e., misalignment, speed, torque) and weight, very high reliability and good maintainability.

The program is a four (4) task program outlined as follows: Task I - the work to be performed shall consist of an extensive investigation of the capabilities and limitations of current helicopter and industrial couplings, with regard to speed, torque, misalignment, lubrication, reliability and maintainability. Task II - selected coupling candidates will undergo a detail design in conjunction with the formulation of an analytical design technique which will be applicable to any range of speed, torque, misalignment, etc., for the concepts chosen. Tasks III IV - specific coupling configurations shall be fabricated and tested. All test data will be analyzed to substantiate the analytical design guide, to validate potential performance gains, and identify possible design deficiencies. All design deficiencies will be corrected by redesign with follow-on verification tests.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0023, ANALYSIS OF HELICOPTER DRIVE SYSTEM ON-CONDITION MAINTENANCE CAPABILITY
W. TRUSTEE, Sikorsky Aircraft, *Stratford, Connecticut* 06602 (DA0D3942; DAAJ02-74-C-0045)

To determine the capability of CH-53 and CH-54 helicopter transmissions and gearboxes to operate without the necessity of scheduled overhauls.

The methodology described in USAAMRDL technical report 73-58, 'Analysis of Criteria for On-condition Maintenance for Helicopter Transmissions,' will be used to analyze failure and depot overhaul data for the CH-53 and CH-54 transmissions. In addition, a Failure Modes and Effects and Criticality Analysis (FMECA) will be performed.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0024, DESIGN, FABRICATE AND TEST OF ADVANCED DEVELOPMENT ROLLER GEAR TRANSMISSION FOR ARMY AIRCRAFT
G. GARDNER, United Aircraft Corporation, *Stratford, Connecticut* 06497 (DA0B4060; DAAJ02-69-C-0042)

Conduct a program to perform experimental, developmental, or research work to design, fabricate and test a roller gear transmission system in an S-61 type helicopter.

The contractor will perform a preliminary design trade-off study and a detailed design of all components associated with the installation of the roller gear transmission into an S-61 helicopter; manufacture eight (8) roller gear units with spares to support test program; conduct 200-hour bench test; conduct 50 hours aircraft tiedown test; conduct a 1,000 hour reliability program including overload testing; and prepare six (6) individual final reports for publication as the finished product. The 25 hour flight demonstration was recently deleted from the scope of work.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0025, A METHOD FOR PREDICTING HELICOPTER HUB DRAG
T. SHEEHY, United Aircraft Corporation, *Stratford, Connecticut* 06497 (DA0D3944; DAAJ02-74-C-0050)

To develop analytical methods for predicting helicopter hub and interference drag. The results of this work will be combined with methods currently being developed under House Task AM 72-09, to predict helicopter fuselage and pylon parasite drag. The drag prediction methods will then be used to evaluate new aircraft designs and will be made available to industry as a design tool. This project will help achieve the AMRDL goal of making significant advances in the state-of-the-art of predicting helicopter performance.

Identify hub designs that will be used on advanced helicopters such as UTTAS and the AAH. Apply analytic techniques and make use of existing data to investigate the flow field in the hub area and identify parameters that are important in determining

hub drag. Based on the results of the study, recommend a wind tunnel test program to allow a systematic study of the parameters that effect the hub drag.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0026, ADVANCED TECHNOLOGY V/STOL PROPELLER CRITICAL COMPONENTS INVESTIGATION
G. WALZ, United Aircraft Corporation, *Windsor Locks, Connecticut* 06096 (DA0C4017; DAAJ02-72-C-0012)

To evaluate an advanced V/STOL propeller concept for future Army aircraft.

Design, fabricate and test a full-scale boron aluminum blade retention system and a full-scale titanium propeller hub with hub reinforced with boron-epoxy or other optimized material to improve stiffness of titanium hub in critical areas. The propeller system shall be designed for a 2000 shaft horsepower and shall be compatible with both conventional (collective) and cyclic pitch designs.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0027, HINGELESS ROTOR SERVO-AEROELASTICITY 9549-E
M.I. YOUNG, Univ. of Delaware, School of Engineering, *Newark, Delaware* 19711 (DA0C9246; DA-ARO(D)-31-124-71-G112)

To investigate the unique servo-aeroelastic characteristics of hingeless rotors. Hingeless rotors offer much promise for improved helicopter handling qualities as well as application to tilting propeller-rotor aircraft and stopped-stowed rotor aircraft. This study will complement advanced computer math models for helicopter aeroelastic studies.

Equations governing a single hingeless rotor blade will be developed, the dynamic stability of both small and large oscillations of individual blades will be studied, and the stability of the overall aircraft hingeless rotor system will be tested.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

1.0028, IN FLIGHT POWER MEASUREMENT AND POWER AVAILABLE MEASUREMENT IN A HELICOPTER
G. BORN, U.S. Dept. of Defense, *Washington, District of Columbia* 20301 (DOD-150-6222)

Description: An in flight measurement of engine turbine power has been developed, and will be tested. Initial work has been done to determine in flight the power still available without an explicit weight measurement.

SUPPORTED BY U.S. Dept. of Defense - Army

1.0029, ANALYSIS OF HIGH-POWER COMPOSITE ENGINE PERFORMANCE
R.D. BUHLER, Univ. of Stuttgart, Inst. For Aerospace Propulsion, *Stuttgart, Baden Wuerttemberg, Federal Republic of Germany* D7000 (DA0C9362; DAER075G001)

The proposed aerothermochemical analysis considers composite propulsion systems combining rocket and airbreathing components for special missions with greatly changing flight conditions, high acceleration requirements and/or V/STOL capability.

The performance capabilities of selected system configurations of this group are to be compared for simplified prototype mission-profiles on the basis of the aerothermodynamic performance results combined with estimated system weights.

Supporting agency address information: AMC European Research Office, Box 15, US Army FPO NY 09510

SUPPORTED BY U.S. Dept. of Defense - Army

1.0030, RESOURCE ALLOCATION IN TRACKING TARGETS WITH MIXED INSTRUMENTATION SYSTEMS 12848-R-M
B. SIVAZLIAN, State University of Fla. Sys., School of Engineering, *Gainesville, Florida* 32601 (DA0E8988; DAHC04-75-G-0049)

To develop optimization techniques applicable to the allocation of range resources to missile and aircraft testing. The proposed research is relevant to existing resource allocation problems at WSMR. In particular, the choice of instruments to be used on a missile test could be made using this technique.

The research involves the mathematical formulation and solution of the problem of mix instrument systems. Specifically, the Principal Investigator will derive explicit expressions for error estimates when using instruments of different types, derive an expression for the reliability function of the particular instrument mix and develop a cost objective function.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Durham, NC 28206

SUPPORTED BY U.S. Dept. of Defense - Army

1.0031, INTEGRATED ENGINE ACCESSORIES, ARMY AIRCRAFT
R. MILLER, United Aircraft Corporation, *West Palm Beach, Florida* 33402 (DA0D3781; DAAJ02-73-C-0003)

Design and evaluation of a complete control and accessory system applicable to a small turbo-shaft engine to take full advantage of advanced concepts of component integration, combination of functions, or new methods of performing functions resulting in improvements in reliability, maintainability, vulnerability, cost, weight, etc., for Army aircraft engines.

Conduct industry survey of potential control and accessory vendors. Conduct conceptual design and trade-off studies. Select one system for final design and problem identification. Conduct limited experimental evaluation of those subsystems considered to be critical to continued successful development.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0032, IMPACT LOAD-DEFLECTION TESTS FOR SOIL MATERIALS
B.M. CRENSHAW, Lockheed Georgia Company, *Marietta, Georgia* 30060 (109521 (HRB NO.))

The purpose is to provide soil load deflection characteristics needed for improving performance, flotation, and dynamic loads calculations for airplanes operating from improved airfields. A test program will be conducted on two soil materials, sand and clay, at impact sink rates up to 15 ft./sec. Results will consist of load deflection curves for different impact velocities.

Document provided to S.S.I.E. by the H.R.I.S.

SUPPORTED BY Lockheed Aircraft Corp. - Burbank, Cal.

1.0033, LOW EMISSIONS COMBUSTOR DEMONSTRATION, ARMY AIRCRAFT GAS TURBINE ENGINES
D.L. TROTH, General Motors Corporation, *Indianapolis, Indiana* 46206 (DA0D3926; DAAJ02-74-C-0025)

To demonstrate the performance and durability of two previously developed low emissions combustors in an actual engine environment; to validate the capability of the low emissions combustors to function throughout the required engine operating range; and to determine if the combustor emission reduction design techniques are compatible with other engine requirements. The low emissions combustor technology from this program will be applicable to the design of advanced, low polluting, increased life gas turbine engines for Army aircraft systems.

Modify and refine the two (2) existing combustor designs; conduct combustor rig tests and further modifications and retests as required to attain conventional T63 combustor performance. Install the final designs (based on results of the combustor rig tests) in a T63 class engine and conduct tests over a wide range of operating conditions including power transients, coking endurance, cyclic durability and emissions measurement tests.

Supporting agency address information: AVSCOM Air Mobility R D Lab, Eustis Directorate, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0034, FLIGHT DYNAMICS--WIND TUNNEL EXPLORATORY DEVELOPMENT TESTING AND WT OPERATIONS BALLISTIC TECHNOLOGY
R.H. KRIEGER, U.S. Army, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0A4561)

This project covers exploratory development tests and applied research programs in the field of aerodynamics and flight mechanics which contribute to the rational design of projectiles, missile, shell and rockets. These studies permit accurate evaluation of new weapons systems and flight environnments of future weapon systems from point of view of design and/or detection.

Exploratory development tests and applied research programs associated with this work are conducted in closed circuit, variable density subsonic, transonic, supersonic and hypersonic wind tunnels. This task covers the operation and maintenance of the wind tunnels along with the improvement of testing techniques, the updating of instrumentation and equipment and the assuring that a continuous high quality testing capability is carried out.

Supporting agency address information: AMC Ballistic Research Labs, Aberdeen PG, Md 21005

SUPPORTED BY U.S. Dept. of Defense - Army

1.0035, CANARD CONTROL FOR MISSILES
F.J. REGAN, U.S. Navy, Aerodynamics Department, *Silver Spring, Maryland* 20910 (DN485028)

The objective of this program is to overcome the roll stabilization problems associated with canard-controlled air-to-air missiles.

An experimental program will be initiated to investigate methods for reducing or eliminating roll of canard-controlled air-to-air missiles, especially in the presence of large maneuvering loads. This effort will be separated into a rolling and a nonrolling (static) part. In the rolling tests a model will be used with a commutating mechanism to maintain the canard lift vector in a fixed spatial orientation. The model will be mounted on an axial support which will permit model spin. At test Mach numbers of 0.85, 2.0 and 3.0, the spin rate of the model will be measured over an angle-of-attack range of minus 25 to plus 25 degrees, or the maximum permitted by the flow geometry. The effects of various canard designs will be evaluated from the point of minimizing or eliminating entirely model spin. The conclusions from this portion of the program will be expressed in a form of spin rate versus angle of attack for various Mach numbers and orientation of the canard lift vector. In the nonrolling tests the model will be mounted on a static balance and five-component load measurements will be made over an angle- of-attack range. This investigation will be limited to the canard and wing configurations which showed the most promise in the rolling tests.

Supporting agency address information: Naval Air Systems Command AIR-320C, Department of the Navy, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0036, AXIAL CENTRIFUGAL COMPRESSOR PROGRAM, ARMY AIRCRAFT PROPULSION
A. BROOKS, General Electric Company, *Lynn, Massachusetts* 01910 (DA0C3981; DAAJ02-71-C-0050)

To provide advanced compressor technology to meet the requirements of future engines in the 2-5 lb/sec airflow class for Army aircraft, particularly helicopters. Reduced fuel consumption, weight and vulnerability and increased reliability goals lead to compressors having fewer stages, higher pressure ratios and increased efficiency.

Design, fabricate, test and analyze data from tests of a compressor having two axial stages followed by one centrifugal stage and having overall pressure ratio target of 15-1 at 5 lb/sec airflow. Separate tests are to be performed of the axial and centrifugal parts and of the overall compressor. The results of data analysis is expected to permit modifications and retesting for improved efficiency.

Supporting agency address information: AVSCOM US Army Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0037, ANALYTICAL AND EXPERIMENTAL IR RADIATION INVESTIGATION OF TURBOSHAFT EXHAUST PLUME RADIATION SUPPRESSION, ARMY AIRCRAFT ENGINES
T. LOFTUS, General Electric Company, *Lynn, Massachusetts* 01910 (DA0D3818; DAAJ02-73-C-0048)

The objective of this program is to develop the technology required to suppress engine exhaust plume radiation levels in Army aircraft.

The program is divided into four tasks. (1) Task I will refine Scorpio I computer for predicting turboshaft engine exhaust plume radiation levels and predict levels for a T53 and T55 engine at selected power settings. (2) Task II will verify the predictions through engine tests and infrared measurements. (3) Task III will investigate a matrix of exhaust plume suppression concepts. Four promising concepts will be selected for design and fabrication and evaluation. The evaluation will be conducted on the engine test stands with radiation level measurements for comparison with predicted levels. (4) Task IV will be an analysis of the Task III data and refinement of the computer program and/or suppression concept designs. The refinement will be subject to verification.

Supporting agency address information: AVSCOM Air Mobility R D Lab, Eustis Directorate, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0038, FLIGHT PERFORMANCE OF GLIDING DECELERATOR SYSTEMS
T.F. GOODRICK, U.S. Army, Natick Development Center, *Natick, Massachusetts* 01760 (DA0G4226)

To analyze the factors necessary to achieve satisfactory flight performance of gliding decelerator systems used to airdrop troops and supplies under exceptional circumstances.

Various analytical techniques and some experimentation will be used to study the various aspects of gliding flight with flexible decelerators and the interrelations of the various aspects. In addition to steady flight characteristics, unsteady flight characteristics such as transition from opening to guided gliding path, response to control actuation, response to wind perturbation and performance of transient landing maneuvers will be studied.

Supporting agency address information: AMC Natick Development Center, Natick, Ma 01760

SUPPORTED BY U.S. Dept. of Defense - Army

1.0039, TACV DULLES PROJECT
UNKNOWN, Alexander Kusko Incorporated, *Needham Heights, Massachusetts* 02194 (111100 (HRB NO.))

Engineering data services on the propulsion and electrical systems for the tracked air cushion vehicles/dulles project are provided.

Document provided to S.S.I.E. by the H.R.I.S.

SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

1.0040, BI-CASTING AN AIR-COOLED RADIAL TURBINE
P.R. SMOOT, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0C4811)

The production of an air-cooled radial turbine would be beneficial to the realization of smaller gas turbine engines with higher specific horsepower and lower specific fuel consumption. Bi-casting has the potential for production of the part with acceptable mechanical properties throughout and with a low reject rate. It is the intent of this project to develop the necessary parameters to produce a satisfactory bi-cast radial turbine. Program thrust is cost reduction.

Lack of bonding between blade root and hub experienced in the past was due to the presence of a reaction product in the interface. This material will be analyzed and a means for preventing its formation or removing it devised. Rotors will be cast using this method and evaluated.

Supporting agency address information: AMC Materials Mechanics Res Ctr, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

1.0041, CRASHWORTHINESS AND OCCUPANT PROTECTION IN GENERAL AVIATION AIRCRAFT ACCIDENTS

R.G. SNYDER, Univ. of Michigan, Highway Safety Research Inst., *Ann Arbor, Michigan* 48105 (106343 (HRB NO.))

Injury-crashworthiness design relationships in general aviation aircraft accidents are being investigated. Data collected to date indicate that even when cabin structure remains intact, occupants often receive serious or fatal injury from instrument panel and control projections, lack of adequate restraint protection, and other factors. Biomedical and human factors investigation of any injury-producing Michigan aircraft accident is continuing.

Document provided to S.S.I.E. by the H.R.I.S.

SUPPORTED BY University of Michigan

1.0042, APPLICATION OF ACOUSTIC EMISSION TECHNIQUES TO HELICOPTER ROTOR SYSTEMS

R.M. RUSNAK, Bendix Corporation, *Southfield, Michigan* 48076 (DA0D3839; DAAJ02-73-C-0066)

The objective is to investigate the feasibility of monitoring the structural condition of helicopter rotor blades by detecting and interpreting the acoustic emissions generated in the blades by the forces of flight. Safety and maintenance benefits would accompany the successful application of acoustic emission technology to this end.

The approach is to empirically identify the acoustic emission characteristics, first of various blade material and construction samples, and then of actual blade sections dynamically loaded. Based on these results an acoustic emission monitoring system will be designed, assembled and applied to actual blade sections subjected to simulated flight loads imposed by a rotor blade fatigue test rig.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0043, ROLL AXIS HYDROFLUIDIC STABILITY AUGMENTATION SYSTEM DEVELOPMENT FOR ARMY AIRCRAFT

R.A. EVANS, Honeywell Incorporated, *Minneapolis, Minnesota* 55413 (DA0D3828; DAAJ02-73-C-0056)

The objective of this program is to develop the roll axis of a hydrofluidic stability augmentation system for army aircraft systems. The ultimate objective is to apply the results to the 6.3 hydrofluidic operational suitability program, which has the objective of demonstrating the operational suitability of the hydrofluidic stability augmentation system as compared with existing systems.

The approach is to design and develop a miniaturized hydrofluidic roll axis system. The program will consist of the analysis, design, fabrication, laboratory performance testing, and flight testing of the hydrofluidic roll axis system.

Supporting agency address information: Avscom Air Mobility R D Lab, Eustis Directorate, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0044, TACTICAL LANDING SYSTEM GUIDANCE TECHNIQUES

P. DEMKO, U.S. Army, Avionics Laboratory, *Red Bank, New Jersey* 07703 (DA0B3400)

To develop a landing system technique that has (a) high potential for providing satisfactory performance in the Army's severe tactical environment, and (b) sufficient versatility to permit determination of guidance system parameters necessary for safe helicopter instrument approaches under tactical operational conditions.

Develop a flexible scanning beam landing system (a-scan) under contract with airborne instruments laboratory to provide selectable glide slope angles, multiple localizers, variable horizontal and vertical course widths, optional dme, course softening, split or colocated siting, and altitude above touchdown. An in-house flight research program (landing flight research facility) is being conducted to evaluate scanning beam guidance techniques and to determine necessary features of follow-on fieldable equipment.

Supporting agency address information: ECOM Avionics Lab AMSEL-VL- D, Ft. Monmouth, NJ 07703

SUPPORTED BY U.S. Dept. of Defense - Army

1.0045, DOPPLER SIMULATION MODEL

M. FISHER, U.S. Army, Electronics Command, *Red Bank, New Jersey* 07703 (DA0C3415)

Doppler sensors are becoming increasingly attractive candidates for future navigation systems as their cost projections decrease and their performance potential improves. Future navigation system synthesis will require effective simulation models of the candidate sensors to ease hardware implementation. The objective of this subtask is to provide an effective simulation model of a Doppler sensor for future navigation system synthesis efforts.

Available literature - scientific papers and reports will be surveyed to determine the availability and suitability of previous efforts. Information will be sought from industrial experts and the total combined with internally developed computer modelling techniques to produce the desired doppler simulation model. Hardware validation of the Doppler simulation model will be effected utilizing data from the on-going low-cost, lightweight Doppler program.

Supporting agency address information: ECOM Avionics Lab AMSEL-VL- D, Ft. Monmouth, NJ 07703

SUPPORTED BY U.S. Dept. of Defense - Army

1.0046, SELF-CONTAINED HYBRID TDMA SYSTEMS

M.J. FISHER, U.S. Army, Avionics Laboratory, *Red Bank, New Jersey* 07703 (DA0D2803)

The US Navy (NADC Johnsville) has been developing and evaluating a radio ranging system designated as ITNS. ITNS (Integrated Tactical Navigation System) is a time-ordered range measurement system which uses synchronized radio signals for command and control, communication, and position location between members of the radio net. Each member of the net uses these signals in conjunction with its own self-contained, dead reckoning system to establish its location in a relative grid or community. The Navy in recent years has been conducting flight tests to prove the feasibility of the ITNS system. Tests were conducted at NADC, Johnsville and on board an aircraft carrier during sea maneuvers. All these tests were conducted using Navy aircraft and ships equipped with inertial navigation systems. The Navy presently plans to evaluate the ITNS concept with a 'mixed community,' i.e., using a combination of other dead reckoning navigation systems such as inertial and Doppler/AHRS. Army participation in these tests will be using an Army aircraft equipped with Doppler/AHRS system as another member of the ITNS community. The overall objective of the program is to evaluate the use of time ordered range measurement information for position determination in a relative grid environment. The use of external range data to update self-contained dead reckoning systems has applicability to all presently considered external references - Loran, satellite, Tacan, Omega, as well as current self-contained systems inertial, Doppler, and air data.

Participate in Navy flight test of ITNS at NADC Johnsville using Army helicopter (UH-1) equipped with a dead reckoning navigation system using a fixed antenna Doppler sensor in conjunction with a heading and attitude reference system (AN-ASN-90) in the backup mode. Army helicopter will operate from Lakehurst flying independently into test range established by the Navy and will then become a user of the ITNS relative grid.

Evaluation will include: (1) the length of time for the aircraft system to be acquired by the grid; (2) the use of the grid for navigation under various army flight profiles; (3) the assessment of calibration on the dead reckoning system after losing or exiting the grid; and (4) the use of the grid for target designation and target hand off to assault helicopter for fire control missions. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense - Army

1.0047, MICROWAVE AIRCRAFT DIGITAL GUIDANCE EQUIPMENT
J. SAGANOWICH, U.S. Army, Avionics Laboratory, *Red Bank, New Jersey* 07703 (DA0C3438)

To evaluate a United Kingdom portable microwave landing guidance system known as MADGE (Microwave Aircraft Digital Guidance Equipment).

A joint services (Army and Air Force) evaluation team will observe/participate in the United Kingdom's test and evaluation of MADGE at the Blind Landing Evaluation Unit (BLEU) in Bedford, England.

Supporting agency address information: ECOM Army Avionics Laboratory, Army Electronics Command, AMSEL-VL-N-L, Ft Monmouth, NJ 07703

SUPPORTED BY U.S. Dept. of Defense - Army

1.0048, MULTIPLE AIRCRAFT APPROACH LANDING TECHNIQUES
J. VOLPE, Cutler Hammer Incorporated, *Farmingdale, New York* 11735 (DA0C3435; DAAB07-73-C-0208)

The objective of this task is to determine the ability of candidate tactical landing systems to provide useable guidance for multiple (closely spaced) aircraft landings. Under this this task a collocated KU-band landing interrogator set will be integrated with an AN/TPX-42, the DOD standard ground interrogator set. Also, the A-scan airborne landing set (an Army exploratory development equipment) will be interfaced with the standard airborne transponder AN/APX-72. The total system will operate in a crossbanded mode wherein the airborne L-band transponder is caused to reply to 'interrogating' KU-band scanning beam landing system signals which are, at the same time, providing the pilot with the usual approach and landing information. With this system, the positions of several aircraft performing simultaneous approaches to the landing system can be determined (on the ground) with a resolution satisfactory for high-density landing experimentation.

The contractor will design, develop, fabricate, test and integrate- interconnect a KU-band landing/interrogator set with the AN/TPX-42 interrogator set for crossbanded operation. Laboratory, field and flight tests sufficient to demonstrate the suitability of the equipment will be conducted by the contractor prior to delivery to USAECOM. Further testing will be conducted at USAECOM where the equipment will be subjected to a high-density helicopter landing environment.

Supporting agency address information: ECOM Avionics Lab AMSEL-VL- N, Ft Monmouth, NJ 07703

SUPPORTED BY U.S. Dept. of Defense - Army

1.0049, AIRBORNE CONFORMAL PHASED ARRAY ANTENNA SYSTEM
M. SIMPSON, Sedco Systems Incorporated, *Farmingdale, New York* 11735 (DA0D1901; DAAB07-72-C-0239)

To develop phased array antennas which conform to the contour of the nose portion of the UH-1 and/or LOH helicopters' fuselage and which are scannable in azimuth and have a beam shaped in elevation. Also, develop a means for stabilization of such antennas for yaw, pitch and roll. Do this in order to provide improved airborne, forward-looking MIT radars.

Perform a theoretical and experimental investigation which consists of: (a) the analysis of applicable techniques, and (b) the design, construction, test and evaluation of a demonstration model configured for the UH-1 and/or LOH helicopters.

Supporting agency address information: ECOM CS TA Lab AMSEL-CT-R, Ft Monmouth, NJ 07703

SUPPORTED BY U.S. Dept. of Defense - Army

1.0050, DESIGN OF EXPERIMENTS FOR HIGH DENSITY HELICOPTER LANDING
G. LITCHFORD, Litchford Electronics Inc., *Northport, New York* 11768 (DA0C3419; DAAB07-72-C-0196)

The objective of the design of experiments is to identify the experimental variables involved in high density helicopter landings (HDHL's), input variables, output variables, their weighting factors and interactions, and to devise testing procedures for determining the ability of the candidate landing system to provide adequate guidance information. Typical input variables include physical characteristics of the Army helicopter terminal environment, number and type of aircraft, density of aircraft, and geometry of site. Typical output variables include landing signal guidance quality, pilot workload, complexity of approach and acquisition procedures, number and type of aircraft in the system, and landing rate. The design of experiments and associated test procedures will be based upon a crossbanded landing guidance facility which consists of an integrated KU-band landing system, an AN/TPX-72 interrogator set, and airborne equipment consisting of an integrated landing system airborne set and the standard transponder AN/APX-72.

The contractor will identify the experimental variables involved in HDHL's including input variables, output variables, their weighting factor and interactions. The contractor will specify methods and parameters to be used in the evaluation of the response of an HDHL system to tests. This will include the determination of system parameters to be measured during the test, identification of experimental variables, method of measurement, number and frequency of test runs and block diagram of required instrumentation. An HDHL test plan resulting from the design of experiments will be formulated.

Supporting agency address information: ECOM Avionics Lab AMSEL-VL- D, Ft Monmouth, NJ 07703

SUPPORTED BY U.S. Dept. of Defense - Army

1.0051, INVESTIGATION OF SMALL TURBINE AERODYNAMICS T-4-E
W. TABAKOFF, Univ. of Cincinnati, School of Engineering, *Cincinnati, Ohio* 45221 (DA0C8956; DAHC04-69-C-0016)

To study the basic phenomena underlying the performance of airbreathing propulsion systems to increase performance by improving the turbomachinery, reducing the overall engine weight, improving the structural design and improving the performance of the nozzle. This project is directed toward those metallurgical and aerodynamical features indigenous to the design and performance of air-breathing propulsion engines such as gas turbines used for military purposes. In attaining best engine efficiency, aerodynamic knowledge of the gas or air flow about the turbine blades is very necessary. It is equally necessary that proper cooling methods and better turbine blade materials be developed for the blade to protect it from burnout or overheating.

Theoretical and experimental investigations are planned in the following areas: heat transfer, cascade flow, stresses and vibrations, blade erosion and solid particle impingement, gas flow mixijg, transonic nozzle performance, high temperature materials, and dynamic distortion. All of the studies will be oriented toward high-temperature analyses, since advanced systems will operate at significantly higher engine cycle temperatures.

Supporting agency address information: AMC Army Rsch Office, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

1.0052, OHIO AIRPORT SYSTEM PLAN - THIRD-LEVEL AVIATION STUDY
G.M. CLARK, Ohio State University, Graduate School, *Columbus, Ohio* 43210 (095179 (HRB NO.))

The two principal objectives are to determine: (1) the future potential of third-level aviation in Ohio by identifying potential third-level air routes and assessing their economic feasibility, and (2) the impact of possible state policies on the future performance of third-level aviation in meeting the needs of Ohio travelers. To accomplish these objectives, demand forecasting models for both commuting and connecting passengers were constructed from a nationwide data base. These demand forecasting models are used in an intrastate aviation network analysis model to predict revenues, costs, and enplaned passengers by route.

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SUPPORTED BY Dalton Dalton Little Newport - Cleveland

1.0053, INVESTIGATION OF ACCELERATED LIFE PREDICTION TECHNIQUES FOR ARMY HELICOPTER COMPONENTS
J.A. COLLINS, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DA0D3921; DAAJ02-74-C-0033)

The objective is to derive mathematical models for the wear failure mode and to develop accelerated test techniques for wear based on these models.

Current theories of the wear phenomena were examined for validity and applicability to mathematical modelling. A machine capable of accelerated testing for the wear and fretting wear failure modes was designed.

Supporting agency address information: AVSCOM US Army Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0054, DYNAMIC LOADS AND STRUCTURAL CRITERIA, ARMY HELICOPTERS
S.W. RUSSELL, Technology Incorporated, *Dayton, Ohio* 45431 (DA0D3902; DAAJ02-74-C-0017)

The purpose of this procurement is to improve structural design criteria by establishing mission profile definitions that are representative of intended helicopter usage and that provide uniform design requirements. Mission profiles will be developed for observation, utility, utility tactical assault, attack, crane, and transport type helicopters. Major differences between model specifications and utilization will be discussed. The results of this effort will have broad application throughout helicopter design; for this reason, two contracts have been let to accomplish this work--one to a helicopter company and one to a non-helicopter company.

Mission profiles for several types of helicopters will be developed from operational data, original model specifications, and applicable military specifications. Major differences between model specifications and utilization data will be examined and related to the new profiles being developed. Mission profile segments in which high loading, high vibration, and/or high fatigue damage rates occur will be identified.

Supporting agency address information: AVSCOM Air Mobility R D Lab, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0055, ADVANCED SMALL AXIAL TURBINE TECHNOLOGY FOR ARMY AIRCRAFT
H. DUE, Teledyne Industries Inc., *Toledo, Ohio* 43697 (DA0C4114; DAAJ02-72-C-0117)

The objective of this program is to define, through aerodynamic investigations of small, cooled, high-work, axial-flow turbine configurations, empirical correlations that will aid in the design of turbine components of increased performance and that will improve performance prediction techniques. This program will provide advanced turbine technology to meet the requirements of future engines for Army aircraft in less than the 5 lb/sec air flow class.

Design, fabricate, and test the necessary nozzle and rotor cascades, and single stage axial-flow turbine(s) to provide the empirical data necessary to accomplish the program objective. The program shall be conducted in five phases: (1) preliminary design; (2) turbine cascade investigation; (3) stage investigation; (4) design technique assessment; and (5) modification and test.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0056, INVESTIGATION OF SMALL HARDWARE DESIGN FOR EASE OF MAINTENANCE AND INSPECTION OF ARMY HELICOPTERS
L.D. BARRETT, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D3862; DAAJ02-73-C-0093)

Maintenance history of Army helicopters reflects a need to increase the importance of small hardware during the initial design of helicopters. The objective of this effort is to define the deficiencies of Army helicopter small hardware items as they relate to maintenance and to investigate design concepts and principles which will limit similar problems in future helicopter designs.

Using the results of previous maintenance studies, deficiencies of helicopter maintenance resulting from design or selection of small hardware items such as fasteners, connectors, component attachment devices and common hardware will be more closely analyzed. Determinations concluded from this analysis will be supported by a test program designed to develop the more promising articles.

Supporting agency address information: AVSCOM Eustis Directorate, Air Mobility R&D Lab, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0057, INVESTIGATION OF CH-47C FIXED SYSTEM STALL FLUTTER DAMPING
J.M. BASKIN, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D3915; DAAJ02-74-C-0029)

An investigation shall be conducted to determine if the flight envelope of the CH-47C helicopter can be extended by the introduction of viscous damping in the fixed control system. A further objective shall be that the system investigated will be mechanically simple and will not represent a major modification to the present CH-47C system.

The existing CH-47C control system will be evaluated to determine where in the fixed control system the maximum structural deflections occur relative to the airframe. A damper system will be designed, fabricated and installed at this location without alteration to the primary control system structure. Flight tests will be performed with and without the damping system operative. Data measurements will be limited to that data necessary for evaluation of the concept. The results will be evaluated to determine the effectiveness of the damping in reducing stall flutter and the related control system loads.

Supporting agency address information: AVSCOM Air Mobility R&D Laboratory, Eustis Directorate, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0058, YUH-61A (B/V) OPERATIONAL STATISTICS
S. BLEWITT, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D3941; DAAJ02-74-C-0056)

This effort will develop verfied simulation models of the Boeing Vertol Company's developmental Utility Tactical Transport Aircraft System (UTTAS) helicopter model YUH-61A in the Army's R&M and the more detailed Aircraft Reliability Maintainability Simulation (ARMS) models, using first, inherent or design values of the R&M characteristics of the YUH-61A and then extrapolating to the predicted R&M values of the mature aircraft system operating in and maintained by a typical Army field tactical organization. The models, data and reports will be treated as 'competition sensitive' during the period prior to selection of the UTTAS (YUH-61A or Sikorsky YUH-60A production contractor.

This program will systematically develop five distinct models for use in UTTAS simulation analysis studies. They are: 1st) the Army's validated R&M simulation model of the USN operational twin-engined utility helicopter, the UH-1N, will be given to the contractor to be modified to the proposed UTTAS operational, support and maintenance scenarios to study the impact of the proposed O&M concepts on a well- known operational helicopter; 2nd) design failure rates and a 'perfect' maintenance system; and 3rd) mature failure rates and an 'imperfect' (diagnostic errors, incorrect repairs, etc.) maintenance system in the R&M model; and 4th and 5th) design and mature versions of the ARMS model.

Supporting agency address information: AVSCOM Air Mobility Research and Development laboratory, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0059, DIAGNOSTIC/INSPECTION INTERFACES, ARMY AIRCRAFT
J. DOUGHERTY, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D3916; DAAJ02-74-C-0030)

To study combinations of diagnostic concepts and maintenance/inspection technology in an attempt to establish more optimized schemes for determining the mechanical and structural conditions of Army aircraft.

The objective will be accomplished in two tasks: the first will include a review of various diagnostic, inspection and maintenance studies/developments for the purpose of determining potentially effective diagnostic/inspection/maintenance combinations; the second task will require the development of an analytical method for assessing diagnostic/inspection/maintenance requirements, and the impact of these requirements upon aircraft effectiveness. From this alternate, schemes will be ranked.

Supporting agency address information: AVSCOM Air Mobility R&D Lab, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0060, EVALUATION OF CONTRAST REDUCTION TECHNIQUES FOR ARMY AIRCRAFT
D.R. GUNDLING, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D3948; DAAJ02-75-C-0001)

To determine the effectiveness of passive optical countermeasures developed under Contract DAAJ02-73-C-0060 in reducing the visual detectability of AH-LG in map-of-the-earth flight. Also to verify the applicability of the laboratory simulation used to predict detection ranges and probability in the previous contract.

Field tests will be conducted using a master camouflage pattern- painted AH-LG and an OH-13 with a flat-plate canopy and modified tail boom. Ground-based observers will be used to take detection range data.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0061, HELICOPTER TRANSMISSION VIBRATION AND NOISE REDUCTION PROGRAM
R. HARTMEN, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D3930; DAAJ02-74-C-0040)

To generate clear, concise and usable analytical tools that would, during the design stage of a program, allow the design team the capability to perform trade studies that would yeild drive train components that are dynamically quiet, with inherently longer life and reduced vibration and attendant noise levels.

(1) construct analytical prediction technique and predict vibration/noise levels of baseline transmission; (2) refine analysis/design and fabricate components to reduce vibration/noise levels of baseline transmission; (3) test modified transmission; and (4) compare results and conduct users' conference.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0062, ADVANCED HELICOPTER STRUCTURAL DESIGN INVESTIGATION
D.J. HOFFSTEDT, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D3953; DAAJ02-74-C-0066)

To define advanced structural configurations, utilizing the latest analytical, material and fabrication technology to satisfy requirements of structural efficiency, fail safety, safety and producibility/cost, for a helicopter of the 7000-9000 gross weight class.

The technical approach to the program will be in accordance with following tasks: a. Task I - develop a preliminary design of a baseline aircraft (conventional structure) and preliminary design of aircraft incorporating various advanced structural concepts. B. Task II - conduct weight, cost, and safety analysis of selected designs. C. Task III - conduct advanced aircraft design and baseline (conventional) aircraft comparison with respect to weight, performance, size, cost, etc. D. Task IV - conduct risk/feasibility assessment of the selected design concepts and identify supporting research efforts for highest technology risk areas. E. Task V - free-planet application study.

Supporting agency address information: AVSCOM Air Mobility R and D Lab, Eustis Directorate, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0063, HELICOPTER CRASHWORTHY TROOP SEAT TESTING
M.J. REILLY, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D3928; DAAJ02-74-C-0036)

The objective of this effort is to (1) test and evaluate the forward- and aft-facing troop seat systems previously designed and mocked-up under Contract No. DAAJ02-C-0077, (2) recommend modifications to the proposed draft general military specification entitled MIL-S- XXXX(AV), 'Seat, Helicopter Troop' and USAAMRDL Technical Report 71-22, and (3) deliver to the Eustis Directorate one forward-facing troop seat test article of the approved detail design.

The troop seats of the design(s) developed and mocked-up during contract DAAJ02-72-C-0077 will be fabricated and subjected to static and dynamic testing to permit publication of a draft military specification for troop seats.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0064, ENGINE/TRANSMISSION/AIRFRAME ADVANCED INTEGRATION TECHNIQUES
R. SEMPLE, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D3950; DAAJ02-74-C-0043)

To identify innovative engine/transmission/airframe integration concepts which provide total airflow and power management to meet projected requirements of future Army aircraft, with minimum effect on vehicle performance.

Task I - conceptual analyses. Task II - advanced helicopter preliminary design. Task III - conventional aircraft preliminary design. Task IV - design analysis - conduct comparative analyses of the preliminary designs of three (3) selected advanced concepts and baseline aircraft.

Supporting agency address information: AVSCOM Eustis Directorate, US Army Air Mobility Research and Development Laboratory, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0065, VALIDATION OF ROTORCRAFT SIMULATION PROGRAM THROUGH CORRELATION WITH FLIGHT DATA (HINGELESS)
J. STALEY, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D3939; DAAJ02-74-C-0051)

The purpose of this program is to provide an independent evaluation of the C-81 rotorcraft simulation computer program (written by Bell Helicopter Company) through the comparison of selected flight test and full-scale rotor whirl stand test data with that calculated by the C-81 rotorcraft analysis.

Boeing Vertol shall review and compile unrestricted flight test data for the BO-105 helicopter for comparison with analytical results to be obtained using the C-81 analysis. The contractor shall compile test data to exercise and compare the three major portions of the C-81, i.e., trim, stability and control, and maneuver. The major prediction effort shall be directed within the normal flight envelope of the subject helicopter with representative data points, approaching and on the flight boundaries.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0066, CH-47 CRASH TEST
A. TANNER, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DA0D3851; DAAJ02-73-C-0067)

The objective of this program is to obtain technical data pertaining to the dynamic behavior of large troop/cargo-carrying helicopter structure and major components in the crash environment. Data will be used to develop design criteria which will improve crashworthiness characteristics of future army aircraft, thus enhancing survivability and improving mission capability.

A crash-damaged CH-47C helicopter will be repaired by the contractor to the extent that major structure and high mass components are representative of a flightworthy aircraft. Various seating systems will be installed and instrumented, and instrumentation to measure structural deflections will be mounted in critical areas. In a joint Army/NASA effort, the helicopter will be dynamically crash tested on the Lunar Lander Facility at Langley Research Center. Data will be reduced and analyzed and a final report will be published. In addition to repairing the aircraft, Vertol will provide 600 man-hours of engineering to assist in pre-test, test, and post-test activities.

Supporting agency address information: AVSCOM Air Mobility R&D Lab, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0067, DYNAMIC TESTING OF COMPOSITE MATERIAL HELICOPTER TRANSMISSION HOUSING
C.E. BRADDOCK, Bell Helicopter Company, *Fort Worth, Texas* 76101 (DA0D3817; DAAJ02-73-C-0038)

To determine the effect of increased housing stiffness on extending gear and bearing life by reducing misalignment under load. The use of high modulus composite materials in helicopter transmission housings potentially can reduce the number of overhauls required and extend transmission lives on future Army aircraft.

A graphite/epoxy UH-1 transmission housing fabricated under a previous contract will be used in the assembly of a complete transmission. The transmission will be instrumented and run at varying power levels to evaluate gear tooth patterns, housing, deflections, and temperature distribution as a function of overall torque.

Supporting agency address information: AVSCOM Eustis Directorate, Air Mobility Research and Development Laboratory, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0068, HIGH SURVIVABLE TRANSMISSION, ARMY HELICOPTERS
C.E. BRADDOCK, Bell Helicopter Company, *Fort Worth, Texas* 76101 (DA0D3904; DAAJ02-74-C-0019)

Previous research efforts have etablished the fact that heat dissipation and loss of lubrication present serious problems in the operation of Army helicopter transmissions under combat situations. The objective of this work effort is to prepare a design of an integrated transmission system for the AH-1G/Q helicopter that will be capable of operation for 60 minutes after a ballistic damage to the transmission case or lubrication system.

It is planned to utilize the results of previous zero lubrication and thermal mapping of transmission systems, conduct an engineering analysis of the AH-1G/Q helicopter transmission, prepare a design of an intergrated main transmission to include a pump and sump pump and demonstrate by test the operational capability of the system after loss of normal lubrication under the best cruise conditions.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0069, AERODYNAMIC AND STRUCTURAL LOADS SURVEY OF A HELICOPTER ROTOR DURING OPERATIONAL MANEUVERS
C. COX, Bell Helicopter Company, *Fort Worth, Texas* 76101 (DA0D3870; DAAJ02-73-C-0105)

A knowledge of the aerodynamic and dynamic phenomena associated with the operation of a teetering rotor during high speed maneuvers is desired. Accordingly, the immediate objective of this program is to comprehensively instrument and flight test an AH-1G helicopter to acquire the necessary data to quantitatively describe the rotor's operation and the attendent responses of the total vehicle during flight. The description of the vehicle that will be provided by this type data will result in more accurate prediction tools and, consequently, improved design criteria and military specifications. An immediate usage for such data would be in support of the current AAH helicopter development program.

An AH-1G will be extensively instrumented to measure blade span and chordwise pressures, stresses, and motions and attendant airframe response for various flight conditions, particularly high speed maneuvers. Predictions of aerodynamic and structural loads made prior to flight using the Bell C-81 computer program will be compared to measured data.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0070, ON-CONDITION CRITERIA ANALYSIS FOR DYNAMIC COMPONENTS OF UH-1 AND AH-1 HELICOPTERS
G. KNUDSEN, Bell Helicopter Company, *Fort Worth, Texas* 76101 (DA0D3943; DAAJ02-74-C-0060)

To determine the capability of UH-1 and AH-1 helicopter transmissions, gearboxes, main rotor hub, and swashplate to operate without the necessity of scheduled overhauls.

The methodology described in USAAMRDL Technical Report 73-58, 'Analysis of Criteria for On-condition Maintenance for Helicopter Transmissions,' will be used to analyze failure and depot overhaul data for the UH-1 and AH-1 transmissions. In addition, a Failure Modes and Effects and Criticality Analysis (FMECA) will be performed.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0071, ROTOR FREQUENCY AND STABILITY ANALYSIS FOR THE ROTORCRAFT FLIGHT SIMULATION
T. MCCLARTY, Bell Helicopter Company, *Fort Worth, Texas* 76101 (DA0D3990; DAAJ02-75-C-0025)

To develop a rotor natural frequency and stability analysis for the rotorcraft flight simulation, computer program C-81.

A computer program will be provided to predict blade natural frequencies and mode shapes compatible with C-81. The C-81 program will be revised to improve rotor hub and blade dynamic representation. A survey shall be made of existing rotor stability analysis techniques. The method best suited for C-81 will be incorporated in the program and demonstrated for several cases for which simpler solutions are available and for full scale aircraft.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0072, FLIGHT TEST OF CARBON SEALS FOR UH-1 TRANSMISSION INPUT QUILL
C. TURNER, Bell Helicopter Company, *Fort Worth, Texas* 76101 (DA0D3809; DAAJ02-73-C-0035)

To flight test circumferential carbon seals for UH-1 transmission input quill assembly.

A. Assemble 2 carbon seals in UH-1 quill assembly. B. Green run the assemblies and then install in helicopter. C. Remove from aircraft and inspect. D. Final technical report.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0073, THE OSCILLATION OF LOADS SUSPENDED BENEATH HELICOPTERS
FLOWER, Univ. of Bristol, *Bristol, England, United Kingdom* (DA0B9434; DAJA37-73-C-0447)

To determine the aerodynamic characteristics of bodies suspended and undergoing prescribed and self-induced oscillations in a wind tunnel, and through theoretical analysis determine the form and range of unstable regions. This effort is highly relevant to the heavy lift helicopter (HLH) development since the understanding and prediction of load oscillations will improve flight safety as well as increase the forward speed capabilities.

The investigation is in two parts: the first is to experimentally determine the aerodynamic characteristics of representative bodies when undergoing prescribed oscillation in a wind tunnel; the second is to monitor movements of the bodies, while suspended through various means, and allowed to oscillate. The two tests will be tied together through analytical means to predict the form and range of unstable regions. Suppression of unstable oscillations will also be studied.

Supporting agency address information: AMC European Research Office, Box 15, FPO NY 09510

SUPPORTED BY U.S. Dept. of Defense - Army

1.0074, ROTOR NOISE RESEARCH
S.E. WRIGHT, Univ. of Southampton, Inst. of Sound & Vibration Res, *Southampton, England, United Kingdom* (DA0C9349; DA ERO 124 74 G0080)

Classification, identification and prediction techniques for noise generation of hovering and low forward speed helicopters with special emphasis of rotor excess noise, and analytical modelling and computations for advancing rotors, accounting for compressibility and high speed sources.

The grant will be in two parts: under part I, the Principal Investigator will review the Army's basic research program on helicopter noise generation, conduct seminars at the US Army Air Mobility R&D Lab, Moffett Field, California. Under part II, good quality rotor noise spectra readily available will be analyzed. Where necessary, rotor noise measurements will be made in the field on certain types of helicopters and other rotor devices. Acoustic spectra from above will be analyzed with a view of obtaining information regarding minimum rotor noise criteria (levels of steady lift radiation and rotor self noise), and excess rotor noise. Trends in excess noise as a function of operating conditions will be sought, and information regarding the excess generating mechanisms acquired. In addition, analytical modelling for high forward speed rotor noise will be made: A) Exact radiation equations will be written and programmed for various degrees and kinds of impulsive blade loading. B) Various levels of approximations will then be made to assess their validity. C) Detailed acoustic properties of impulsive blade loading will be established for the exact and approximate solutions. D) Data from wind tunnel and flight test will be used to check the relevance of the equations.

Supporting agency address information: AMC R&D GP (Eur), Box 15, NY 09510

SUPPORTED BY U.S. Dept. of Defense - Army

1.0075, DESIGN CRITERIA FOR ELASTOMERIC BEARINGS FOR HELICOPTER ROTOR AND CONTROL SYSTEMS
A. THOMPSON, Thiokol Chemical Corporation, *Brigham City, Utah* 84302 (DA0D3879; DAAJ02-73-C-0091)

The technical objective of this program is the creation of a comprehensive design manual for elastomeric bearings. The effort includes analytical investigations/developments and tests necessary to define characteristics of the bearings.

Investigations concerning analytical procedures, bearing geometries, test specimen geometries and bearing performance prediction will be conducted. Simultaneously a materials characterization program will be executed to assure that representative materials are selected. Tests of the simple specimens will establish analytical predictions concerning failure initiation and propagation. Tests of full size complex bearings will verify the analytical predictions and procedures. Computer programs will be investigated for applicability in evaluating bearing geometries and loads, and modified as necessary to provide a suitable program for elastomeric bearing analyses. Design and test data accumulated will be evaluated and compiled into the design manual.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0076, HT PP 74-51- MINI REMOTELY PILOTED VEHICLES (RPV) PROPULSION
E.H. DEAN, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0D3977)

The technical objective is to conduct exploratory development of propulsion systems for remotely piloted vehicles (RPV). Effort will encompass the complete RPV propulsion system, including individual components (engines, propellers, etc.) and propulsion system installation investigations. Design, fabrication, and validation testing of engines, engine components, and other propulsion system components will be conducted.

The approach will be to identify and catalogue potential RPV propulsion systems in the 1-50 hp class, identify propulsion problems encountered with previous mini-RPV programs, formulate and initiate an exploratory development program with the objective of providing a reliable RPV propulsion system, conduct investigations leading to validation and selection of potential mini-RPV propulsion systems, and formulate test programs geared towards validating propulsion system performance.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0077, THE STUDY OF OPERATIONAL PROBLEMS AND TECHNIQUES IN WIND TUNNEL TESTING OF VTOL AND STOL VEHICLES 10655-E
W.H. RAE, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105 (DA0A9202; DA-ARO(D)-31-124-72-G190)

To evaluate existing theories for correcting V/STOL wind tunnel data for wall effects. This research will contribute to the improved testing of V/STOL aircraft in wind tunnels. Wall correction theories will be validated and will contribute to better factual understanding of wind tunnel data.

The wall correction theories of Glauret, Heyson and Joppa will be compared with special attention being given to tail corrections which are critical in determining the proper vehicle pitching moments from wind tunnel tests. Additional data will be obtained on different V/STOL aircraft configurations for flow breakdown and the resulting wind tunnel test limits.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, SATELLITE NAVIGATION -- AIRBORNE ANTENNA SYSTEM
E. BEANE, U.S. Army, Electronics Command, *Red Bank, New Jersey* 07703 (DA0C3412)

Investigation of the use of the navigation satellite time and range global system (NAVSTAR GPS) with Army rotary winged aircraft. Specific areas to be investigated are degradation of satellite signal by rotor blade modulation and multipath effects, and cost, effective hybrid augmentation schemes using GPS/Army User Equipment (AUE) with other navigation sensors. This program is coordinated with the NAVSTAR GPS development program managed by a tri-service Joint Program Office (JPO) to avoid duplication of effort.

Antenna systems will be developed and comparatively evaluated through the analysis and testing of various antenna structures with respect to location on aircraft and signal degradation. Study of past and current hybrid satellite navigation investigations and related technical literature: develop GPS receiver/system error models, dynamic aircraft flightpath computer simulations, implement optimal and suboptimal Kalman filter mechanizations for GPS augmented with other systems such as; inertial, inertial strapdown, and Doppler; test proposed promising schemes in dynamic simulations, laboratory and flight tests; develop an in-house GPS receiver digital computer modeling capability as a primary evaluation tool for the performance analysis of proposed GPS receiver designs and hybrid system configurations; and investigate, develop, and optimize UTM coordinate transformation algorithms with regard to software complexity, processing time, accuracy, power consumption, cost, size, and weight.

Supporting agency address information: ECOM Avionics Lab AMSEL-VL- D, Ft Monmouth, NJ 07703

SUPPORTED BY U.S. Dept. of Defense - Army

2.0002, SHF COMMUNICATIONS IN MOTION STUDY
O. GUZMANN, U.S. Army, Satellite Communications Agcy., *Red Bank, New Jersey* 07703 (DA0C5202)

Objective - the program is designed as an extension to the current Army tactical satellite communication program. The program objective is aimed to ultimately result in a truly mobile tactical satellite communication terminal which will provide communications while the vehicle is in motion. In order to achieve true mobility for the highly transportable vehicular mounted units presently being fabricated under contract with RCA, several equally important technical areas need to be explored. The first of the areas to be investigated in-house covers the feasibility of an antenna system which will continuously point at the satellite (stabilized antenna). Other areas which must be investigated are the effects of Doppler, impact of mobility requirements on the communication equipment as presently being designed, prime power utilization, and vehicle configuration.

Approach - the in-house effort is to be initially directed towards the achievement of the antenna system design. Investigation to date indicates an inertial stabilization system may be the more promising approach both in simplicity and from a cost-effectiveness viewpoint. In pursuing this approach, coordination with the Army inertial guidance and control laboratory of the U. S. Army Missile Command will be continued as much as possible.

Supporting agency address information: AMC US ARMY Satellite Communications Agy, Ft Monmouth, NJ 7703

SUPPORTED BY U.S. Dept. of Defense - Army

2.0003, OBSERVATION OF VHF BEACONS ON SATELLITE FE473
K.H. PAI, Natl. Taiwan University, *Taipei, Republic of China* (DA0C9520; DARDRF S92 544 74 G215)

To make observations of the signals from transmitting satellites. Also, scintillation percentage, total electron content, irregularity heights and drift velocities will be measured. This work is relevant to Air Force needs inasmuch as it provides background information on fading characteristics which is essential to design of satellite-to-aircraft and satellite-to-ground VHF communications systems.

Observations of two phenomena will be used to study the ionosphere- scintillation and Faraday rotation. Scintillation phenomenon is believed to be caused by the ionospheric density fluctuations and hence is useful to study irregularities. The Faraday rotation is caused by the mageto- ionic effect and can be used to deduce the electron content.

Supporting agency address information: AMC R&D Group (Far East), APO San Francisco, Ca 96343

SUPPORTED BY U.S. Dept. of Defense - Army

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, ENVIRONMENTAL EFFECTS ON COMPOSITE MOTOR COMPONENTS
W.S. CROWNOVER, U.S. Army, Propulsion Directorate, *Huntsville, Alabama* 35809 (DA0E1306)

The objective of this task is to develop new engineering information for composite materials applicable to solid rocket motor components. Currently, fiberglass, PRD-49, Type III and graphite- reinforced composites are being considered for advanced rocket motor case applications because of their unique properties such as strength to weight and stiffness to weight. These components must operate in a field environment with no loss in rocket motor performance. This task will evaluate these materials in typical Army environments.

Three inch diameter rocket motor cases utilizing fiberglass, PRD- 49, Type III and graphite-reinforced composites will be subjected to typical field temperature and humidity extremes and performance measured. Necessary protective measures for the composites will be probed.

Supporting agency address information: MICOM Propulsion Directorate, Redstone Arsenal, Al 35809

SUPPORTED BY U.S. Dept. of Defense - Army

3.0002, AN IMPACT IGNITION MODEL FOR SOLID PROPELLANTS
H. KRIER, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DA0J4434; DAAD05-73-C-0070)

To develop a generalized impact ignition model based on a one- dimensional solid phase heat balance including chemical heat generation and convective heat transfer.

An impact ignition model will be developed since current ignition models are unsatisfactory for vulnerability. This model will allow predictions of ignition probability due to projectile and fragment impact, time to ignition after impact, and temperature profiles and distribution in the propellant after impact. The effect of compressional and rarefaction waves from the impacting projectile and the propellant- free surface will also be investigated.

Supporting agency address information: AMC Ballistic Research Labs, Aberdeen PG, Md 21005

SUPPORTED BY U.S. Dept. of Defense - Army

3.0003, NONUNIFORM SURFACE REGRESSION STUDIES ON ABLATING PROJECTILES
H. KRIER, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DA0J4468; DAAD05-72-C-0415)

In order to determine possible causes of asymmetric forces that can produce yawing motion on a projectile, a study will be undertaken of possible early burning anomalies during the ignition and successive flame spreading in porous beds of propellant grain.

The approach in this work includes an analytical study of ignition and combustion in a porous propellant charge, taking into consideration propellant grain motion and heterogeneous processes of convective heat and mass transfer. The work is motivated to determine if anomalous early burning can give rise to asymmetric forces on moving projectiles.

Supporting agency address information: AMC Ballistic Research Labs, Aberdeen PG, Md 21005

SUPPORTED BY U.S. Dept. of Defense - Army

3.0004, NON-STEADY COMBUSTION MODELING
J.R. OSBORN, Purdue University, School of Engineering, *Lafayette, Indiana* 47907 (DA0H4532; DAAD05-72-C-0342)

Precise thrust termination of solid rocket motors requires that the combustion processes of the burning propellant be capable of being extinguished upon command. This leads to the requirement that the response of a burning solid propellant to rapid pressure decay be well characterized.

An experimental and analytical program will be conducted for determining the deflagration limits of selected composite rocket propellants. The experimental approach will involve burning the propellant sample in a specially constructed vessel equipped for reproducing the thrust termination environment--that is, steady state burning at an elevated pressure followed by an

extremely rapid pressure decay to atmospheric pressure. The analytical approach will involve extending the existing theoretical work of Ryan. Comparisons of the analytical and experimental work will be made for determining those physical and chemical propellant parameters affecting the deflagration limit of composite solid propellants.

Supporting agency address information: AMC Aberdeen R&D Center, Aberdeen PG, Md 21005

SUPPORTED BY U.S. Dept. of Defense - Army

3.0005, STRESS WAVES IN ABM PROPELLANT
A.S. ELDER, U.S. Army, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0F4550)

To determine what proportion of the observed attenuation is due to scattering effects at ultra-high frequencies. To consider the effect of stress pulses and attenuation on the structural integrity of a solid propellant rocket motor.

Attenuation will be measured as a function of frequency, size of oxidizer particles, and packing fraction in composite propellants of current interest. Tests of the binder alone will also be conducted as a check. The tests will be conducted in the ultra-sonic frequency range, using piezoelectric drivers and transducers.

Supporting agency address information: AMC Ballistic Research Labs, Aberdeen PG, Md 21005

SUPPORTED BY U.S. Dept. of Defense - Army

3.0006, RADICAL MECHANISMS IN IGNITION OF PROPELLANTS
K.J. WHITE, U.S. Army, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0F4424)

One of the theories related to ignition of propellants stresses the importance of solid phase reactions as the most important energy release mechanism in the ignition phenomenon. The objective of this task is to construct a system which will allow the study of initiation of propellants by thermal pulses. Radicals produced by these mechanisms will be detected and analyzed by electron spin resonance (ESR). It is hoped that within the first year some work will have been completed on the initiation of ammonium perchlorate, potassium nitrate and some nitro compounds such as dinitrotoluene, picric acid and nitromethane. The work will be performed at BRL.

To shed some light on the chemical mechanisms in combustion we propose to explore the ignition mechanism by use of spin resonance (ESR) techniques. The production and observation of free radicals by thermal techniques is not a simple matter. Radicals have been produced readily by high energy radiation. Here heating effects are negligible and the crystalline lattice of the compound can act as a trap for the radicals. However, in the heating process of pyrolysis these crystalline fields are broken and the radical is free to migrate and react. Thus we propose to irradiate single crystals held at low temperature with various heating sources in the hope of initiating reactions without a complete breakdown of the crystalline fields. We will also employ other techniques such as photosensitization of the compound. The crystal will be doped with compounds that will enhance the energy transfer mechanism from optical radiation to thermal effects. The chief advantage in using ESR is that the reaction need only proceed a very small amount (0.0001 percent) in order to produce enough radicals for observation. The ESR technique also allows observation of the reaction in the solid state.

Supporting agency address information: AMC Ballistic Research Labs, Aberdeen PG, Md 21005

SUPPORTED BY U.S. Dept. of Defense - Army

3.0007, DEVELOPMENT OF FILLER METALS FOR WELDING ESR ARMOR STEELS USED ON VEHICLES
D.C. BUFFUM, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4704)

To develop filler metals for joining ESR steel armor materials, this effort is needed to develop the full potential of ESR armor and provide maximum protection in armored vehicles. This work unit supports the thrust of survivability - aircraft and combat vehicles. It is keyed to the pacing problem for melting and welding techniques for medium carbon low alloy steel armor.

Alloys of various compositions will be ESR melted and fabricated into wire of suitable diameter for welding. These wires will be used to weld ESR armor of various thicknesses and the weldments will be evaluated by mechanical testing (hardness surveys and tensile tests) and by ballistic tests.

Supporting agency address information: AMC Materials Mechanics Research Ctr, ATTN-AMXMR-ER, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0008, STRESS CORROSION AND CORROSION FATIGUE OF BETA TITANIUM ALLOYS
W. CZYRKLIS, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4756)

The objective of this program is to improve the stress corrosion and corrosion fatigue resistance of beta titanium alloys, which are being used or proposed for use in Army helicopters (rotor hubs) and armored vehicles (suspension torsion bars). Titanium alloys are frequently susceptible to stress corrosion and corrosion fatigue cracking in aqueous environments, so that a great potential for catastrophic failures in these applications may exist.

The stress corrosion and corrosion fatigue susceptibility of beta titanium alloys 'beta III', Ti-8Mo-8V-2Fe-3Al, and Ti-3Al-8V-6Cr-4Mo-4Zr will be determined as a function of alloy chemistry, thermomechanical treatment, and environment. The corrosion-induced fracture behavior of these alloys will be compared with conventional mechanical properties, to determine optimum alloy composition and processing for maximum strength, ductility, and resistance to environmental attack. The usefulness of applied electrochemical potentials and corrosion inhibitors in suppressing corrosion-induced fracture will be evaluated.

Supporting agency address information: AMC Materials Mechanics Res Ctr, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0009, BEHAVIOR OF CASE-HARDENED GEAR AND BEARING MATERIALS
P.J. FOPIANO, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4755)

The objective of this program is to investigate the metallurgical properties of new and improved case hardened gear and bearing materials used in the manufacture of high performance components for Army aircraft and armored vehicles. Of particular importance are high-speed applications as found in helicopter transmissions and high torque applications as found in the drive train of armored vehicles. Improvements will be sought in the residual life of case-hardened components by the optimization of the metallurgical structure. This project's thrust is survivability.

Emphasis in FY76 will continue to be on gear materials. The optimization of the metallurgical structure will be undertaken by the control of the carburizing, heat treatment, and processing procedures of candidate materials. The effect of these processing procedures on microstructure (including ferrite, retained austenite, and transformation products), macrostructure (including segregation and inclusion content) and residual stress will be evaluated. Emphasis during FY76 will be on carburized VAsCo x-2 and 9310 in the vacuum melted (VAR) and electroslag melted (ESR) conditions. Possible correlation of the various physical and mechanical properties with gear performance will be undertaken.

Supporting agency address information: AMC Materials Mechanics Research Ctr, AMXMR-RM, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0010, PHASE STABILITY IN HIGH-TEMPERATURE NICKEL TITANIUM ALLOYS FOR USE IN GAS TURBINE ENGINES
R.D. FRENCH, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0C4817)

To study phase stability in high-temperature nickel and titanium alloys. In particular this project will (a) reduce ductility scatter in cast nickel-base alloys by controlling the microstructure

through thermal cycling, and (b) extend the development of high-temperature titanium alloys through improvement of strength and creep resistance to 1200 degrees F. It is expected that this project will establish phase stability in the alloy systems studied for periods of time comparable to anticipated service life. Project thrust is survivability.

The first task in this project is examining the role of secondary phases in strengthening nickel-base superalloys. Thermal treatments have been developed which reduce ductility scatter in cast alloy 713C and increase the average ductility of commercial material by approximately 50 percent. The treatments are being refined as a commercial process by gaining an understanding of secondary phase reaction kinetics. The second task is an attempt to stabilize the development of aluminide precipitates in high aluminum-content titanium alloys. Beta stabilizing elements have been added to improve workability and reduce the total amount of aluminides.

Supporting agency address information: AMC Materials Mechanics Res Ctr, AMXMR-RM, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0011, STRENGTHENING MECHANISMS IN NICKEL-BASE SUPERALLOYS

R.D. FRENCH, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4798)

To investigate mechanism for strengthening and improving creep resistance in superalloys. Emphasis will be given to the role of carbides in changing strength and ductility. In prior years, the morphology of MC carbides in nickel base alloys has been examined to determine the extent of connectivity and to relate morphological developments to specific thermal treatments. It has been shown that changes in strength and ductility accompany these morphological changes. This project supports problem areas 14.1 and 15.1 of the materials technology plan for aircraft guidance for FY75. In addition, this project directly supports the analyses of fracture in nickel superalloys.

This project will examine the role of secondary phases in strengthening nickel base superalloys. Attention will be directed at those phases which have a primary role in high-temperature strengthening although first efforts will be directed at determining the effects of those phases on room temperature strength and ductility. Specimens will be subjected to appropriate thermal treatments to alter the minor phases.

Supporting agency address information: AMC Materials Mechanics Research Center Attn-AMXMR-EM, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0012, HOT PRESSING OF SILICON NITRIDE FOR PROPULSION AND POWER GENERATION SYSTEMS

G.E. GAZZA, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4741)

Advanced ceramic synthesis techniques are required to reproducibly fabricate silicon nitride ceramics needed by the Army for critical turbine applications such as nozzles, vanes and rotors. Nozzles and guide vanes with improved resistance to erosion and thermal degradation are required for APU's while the development of turbine materials for primary engine components, e.g., rotors, are required for inlet temperature operation greater than 2300 degrees F to increase engine efficiency and reduce replacement down time. The pacing materials problem area is high-temperature materials under the surface mobility mission area. Thrust - cost reduction via fuel economy.

To synthesize silicon nitride ceramics by using various sintering additives and consolidating by pressure sintering. The use of Yttria additives will continue to be explored as well as others, e.g., ceria. Fabrication of simple and complex shapes will be accomplished. Pertinent physical and mechanical properties will be determined up to a temperature of 2700 degrees F.

Supporting agency address information: AMC Materials Mechanics Res Ctr AMXMR-EO, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0013, POLYMERIZATION AND DEGRADATION BEHAVIOR OF NEW POLYMERIC MATERIALS

G.L. HAGNAUER, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0B4776)

To investigate and obtain information on the effects of polymerization, processing, and extreme environmental conditions on the molecular structure and properties of new polymeric materials for special Army applications as fuel resistant, low temperature elastomers, flame retardants, and transparent armor materials. This work will also provide information on structure-property relations of new synthetic or commercial polymers needed to guide applications and to indicate potential for property improvements. Major thrusts - mobile and all- weather air defense, aircraft survivability, deterioration.

The polymerization kinetics of poly(dichlorophosphazene) will be investigated. Special efforts will be made to increase polymer yields and to gain control of polymer structure by modification of polymerization conditions. The degradation behavior and effects of cure conditions and stabilizing agents on the molecular structure and properties of several substituted polyphosphazenes will be determined and compared with polymer materials in current use. The polymerization kinetics and influence of processing conditions on the structure- property relations of certain polyquinoxaline and triazine polymers will also be investigated. Special dilute solution techniques will be used to analyze molecular weights, distributions, polymer chain dimensions, branching, and cross-linking and to fractionate polymers for structure- property studies.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0014, FABRICATION OF COMPOSITE MATERIAL PROTOTYPE/MIXED FIBER COMPOSITES

B.M. HALPIN, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4741)

To provide the basis for increased effectiveness in the use of fiber resin composite materials in Army applications. Depending on the component, weight reductions of 30 to 50 percent can be expected. Composite materials may increase the lifetime and performance of many structures. Standardization of fabrication techniques will be used to increase the reproducibility of final product. This work unit responds to pacing problem areas 1.6, 2.1, 2.2, 2.4, 9.1, 9.2, 22.5, 25.2, 25.3 and 25.4 of the aircraft portion of the preliminary technical guidance for FY76. The work unit also responds to improved composite material for missiles and lightweight antitank weapons and for use of organic materials in vehicle application.

Prototypes and specimens representative of items such as missile components, vehicle drive shafts and helicopter spars will be fabricated from high-performance organic fibers, graphic fibers, and glass using new resin systems. In addition to the fibers alone in a matrix, combinations of fibers will be investigated to establish properties of hybrid configurations. The prototype study will be extended beyond filamentary composites to include structural foams. These foams will be investigated for potential use in many applications formerly employing metal housings, e.g., field radio cases.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0015, VISCOELASTIC CHARACTERIZATION OF FILAMENTARY COMPOSITES

E.M. LENOE, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4750)

To provide the necessary data to effectively assess filamentary composites for use in aircraft and missile applications. Specific objectives include determining the anisotropic viscoelastic functions and characterizing the mechanical response of composite materials of importance in Army material. This addresses the specific pacing problem of design criteria for creep and elevated temperatures. The program thrust is survivability of composite aircraft, missiles, and armament systems.

As they become available, additional composites such as kevlar reinforced plastics and graphite-reinforced aluminum will be characterized under creep and relaxation conditions for various stress states. In addition, studies of response under combined and repeated loadings will be initiated. Several simple structural configurations will be tested in order to validate theories developed to date.

Supporting agency address information: AMC Materials & Mechanics Res Center, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0016, MECHANICS OF BRITTLE MATERIALS
E.M. LENOE, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4698)

To complete materials characterization, evaluation of test techniques, and to provide improved design and analysis procedures for brittle materials. The particular materials are leading candidates for gas turbine applications.

This research will consist of theoretical and experimental investigation of constitutive equations, fracture mechanics, failure theories, thermal and mechanical fatigue and the probabilistic aspects of brittle material behavior. Materials to be investigated include hot pressed silicon nitride and hot pressed silicon carbide.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, AMXMR-TM, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0017, DEVELOPMENT OF ALUMINUM/GRAPHITE COMPOSITE FOR AIRCRAFT
A.P. LEVITT, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4717)

The objectives of this work unit are: 1) to develop advanced, high-strength, lightweight aluminum/graphite fiber composites for structural applications in Army aircraft and missiles. Specific applications include beams, frames, stiffeners, skins, and panels for helicopters and missiles; 2) to evaluate the fatigue, fracture, stress corrosion, and strength properties of aluminum/graphite fiber composites as a function of fiber orientation. Strength and crack growth resistance both parallel and perpendicular to fiber orientation require study to determine failure modes and soundness of the fiber/matrix bond. The program thrust is survivability.

The approach for the first objective includes the fabrication of infiltrated tows produced by AMMRC and by commercial sources into aluminum/graphite structures (such as flat tensile specimens, impact specimens, etc) by solid and solid liquid phase bonding to determine the optimum fabrication methods. The approach for the second objective is to evaluate the Al/G structures produced above for their tensile properties, fracture toughness, fatigue behavior, and stress corrosion susceptibility. Properties will be determined for both transverse and longitudinal orientations for unidirectional fiber reinforcement.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0018, BONDING TECHNIQUES FOR DEVELOPMENT OF A1/G COMPOSITES
A.P. LEVITT, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4700)

To develop, for structural use in Army missiles and aircraft, graphite fiber-reinforced aluminum using Mg/graphite fiber precursors and other wetting and bonding agents. The use of the Mg/G precursor eliminates the Al/G wetting and bonding problem since graphite can be readily wet and bonded to Mg, and since Mg can be readily bonded to Al. The program thrust is survivability - aircraft and combat vehicles.

Studies on the infiltration of Ti-treated woven Thornel 50 and other graphite fiber tapes and yarns with molten Mg will be continued, in order to optimize the process variables of time, temperature and Ti concentration. The resulting composites will continue to be bonded by hot pressing under various conditions, between two layers of al foil to form Al/G composites and evaluated for mechanical properties. Studies of other wetting and bonding agents include but are not limited to chemical and physical vapor deposition of coatings such as Ti and TiC on the graphite yarns prior to infiltrating with the aluminum matrix alloy. The use of liquid alkali metals such as NaK under inert atmospheres will also be investigated as cleaning agents for graphite fibers prior to infiltration. Infiltrated yarns will be evaluated for mechanical properties to identify the most suitable wetting and bonding agents.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, Attn-AMXMR-EM, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0019, COATINGS FOR UPGRADED PERFORMANCE OF GAS TURBINE ALLOYS
M. LEVY, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0B4762)

To develop improved high temperature coatings for titanium alloys, nickel-base superalloys and columbium alloys for application in the compressor and hot turbine section of gas turbine engines in order to upgrade performance through higher turbine inlet temperatures and increases in time-between-overhaul. Coatings to be developed include: a) a hmt salt stress corrosion-resistant coating for titanium alloys (e.g., compressor blades, discs, and centrifugal impellers): b) electrophoretic MCrAlY coatings for superalloys (e.g., airfoils); and c) improved electrophoretic diffusion coatings for columbium alloys (e.g., blades and vanes). Thrust area is survivability - aircraft and combat vehicles.

To mitigate hot salt stress corrosion of Ti alloys between 500 and 1200 degrees F the principle of applying sacrificial coatings which are electrochemically more electro-negative (active) to the substance will be explored. The formation of halides which hydrolyze to produce hydrogen will be a consideration in the selection and evaluation of the coated alloy; oxidation and sulfidation resistant MCrAlY coatings for super-alloys will be developed utilizing less costly electrophoresis or plasma spraying plus diffusion treatments. Coating parameterrs will be optimized to produce minimum substrate embrittlement by controlled diffusion. Performance in the dynamic hot corrosion test rig will be compared to current overlay coatings; oxidation resistant diffusion coatings based on various combinations of Ti, V, W, Mo, and Si will be applied to CB alloys by electrophoresis. The effects of layer composition, diffusion temperature, and coating thickness on oxidation and sulfidation resistance (isothermal and cyclic) will be evaluated.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0020, DEVELOP OF SURFACE TREATMENT FOR UNIFORM CASE DEPTH HARDENING OF X-2 ALLOY GEAR STEELS
M. LEVY, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4801)

To develop a carburizing procedure for x-2 alloy tool steel for use as a gear material for helicopter transmissions. Thrust area is survivability.

Alloy steel VAsCo X-2 and another candidate advanced gear material of vacuum melt grade will be heat treated and case hardened by conventional gas carburizing as well as by vacuum carburizing utilizing mechanical, thermal, chemical, and electrochemical pretreatments to nullify the adverse effect of chromic oxide scale. AlSi 9310 gear steel will be utilized to establish base line data. Evaluation will be made of uniformity of case depth and effectiveness of pretreatments using metallography, hardness surveys, scanning electron microscopy, X-ray diffraction, and other techniques.

Supporting agency address information: AMC Materials & Mechanics Research Center, Attn-AMXMR-EM, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0021, CRACK PROPAGATION BEHAVIOR IN ADVANCED MATERIALS
W.T. MATTHEWS, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0B4707)

To provide, at the design stage, an estimate of fatigue crack propagation life of materiel subjected to deterministic, variable loading, history. This estimate may be interpreted directly as a total life for designs such as gun tubes, where iniation life is negligible. for other designs, this estimate may be combined with an initiation life to provide a total life prediction. The proposed estimation method will be applied to more complex, variable histories of the type which occur in service. Results would provide a more accurate, probably less conservative, estimate of retirement life of gun tubes, reduce fatigue resistant design/development cost for aircraft, helicopters and ground vehicles. This effort addresses RDTTE program thrust G 'survivability' and aircraft pacing Problem No. 3 'Methods for Estimating Residual Fatigue Life.'

Fatigue crack growth rate description results from model which utilizes the crack tip closure phenomenon expressed in terms of linear elastic fracture mechanics. The model also considers residual stress effects for those instances where crack tip closure behavior is absent. Model parameters are evaluated experimentally by the simultaneous measurement of crack tip closure level and crack growth rate. Closure level is detected by an electrical resistance measurement.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0022, NOVEL ARMOR SYSTEMS FOR HELICOPTER SEATS
D.J. PAPETTI, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4705)

To investigate novel armor systems using electroslag remelted (ESR) steel as the principal impact surface. The armor protection will be directed to aircrew safety with particular emphasis on armored helicopter seats.

The approach will include investigating various systems all of which will include ESR steel as the impact material in a monolithic configuration and as the front face of a composite system. The ESR steel will be hardened to high hardness levels and evaluated at various thicknesses and in composite form with various back face materials including aluminum, woven uoving, kevlar, etc. The armor systems will be ballistically evaluated against various projectiles including cal .30ap and cal .50ap.

Supporting agency address information: AMC Materials & Mechanics research Ctr, Attn-AMXMR-ER, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0023, IMPACT PROPERTIES OF GRAPHITE FIBER-REINFORCED COMPOSITE MATERIALS
J.R. PLUMER, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4748)

To quantify the effects of low velocity impact and foreign object damage on graphite fiber-reinforced composite materials. To generate possible solutions to the problem of low impact strength of these composites. The HLH ATC program shows that, in certain applications, these composites have poor impact resistance and foreign object damage tolerance. This project is responsive to the major RDT&E program thrust No. 4.A. Aircraft Survivability, and to the pacing materials problem area, Vulnerability and Survivability of Rotor Blade Components.

Testing of composite samples will be continued. The amount of energy necessary to cause damage, the energy absorbed by the sample, and the type and propagation mode of the failure will be determined. These data will be correlated with the fiber strength, fiber modulus, fiber surface treatment, resin type, and sample construction. The results of these correlations will be used to indicate possible solutions for the problem. Possible modifications to be investigated include: the incorporation of other materials such as Kevlar-49, fiberglass and graphite film; incorporation of rubber particles in the resin; changing the resin; and varying the structure of the composite panel.

Supporting agency address information: AMC Materials & Mechanics Rsch Ctr AMXMR-RD, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0024, FATIGUE BEHAVIOR OF FIBER-REINFORCED COMPOSITES
D.K. ROYLANCE, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4749)

To assess the influence on an accelerated environment (high temperature, humidity, and ultraviolet radiation components) on the fatigue lifetime of fiber-reinforced polymer composites, to identify material degradation mechanisms, and to optimize the environmental fatigue resistance of these composites for use in helicopter rotor blades and flight control elements.

Various thermosetting and thermoplastic matrices, reinforced with glass, graphite, and Kevlar fibers, will be subjected to cyclic tension- tension fatigue loads while exposed to an accelerated deteriorative environment. Statistical lifetime distributions will be obtained as a function of mean load, and the data correlated with current theories of cumulative damage and crack growth in composites. Materials deterioration mechanisms will be identified by analytical chemical and microscopy techniques, and processing methods will be developed to eliminate or minimize these mechanisms.

Supporting agency address information: AMC Materials & Mechanics Rsch Ctr, AMXMR-RD, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0025, STRUCTURAL MATERIALS WITH DAMPING CHARACTERISTICS
R.J. WEISS, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4751)

(A) To investigate the fundamental atomic mechanism of vibrational damping in such materials as nitinol TiNi, Cu3Al, MnCu and Fe3Pt in order to be able to predict other systems that might show damping characteristics. (B) To produce a viable structural alloy with high damping for use in reducing helicopter transmission noise.

Simultaneous physical properties such as specific heat, resistivity, elastic constants, soft vibrational modes, optical properties will be measured as a function of temperature and correlated to the damping. The effect of metallurgical treatment on the strength and damping will be examined.

Supporting agency address information: AMC Materials & Mechanics Res Center, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0026, DEVELOPMENT OF POLYMERIC MATERIALS FOR TRANSPARENT LIGHTWEIGHT ARMOR
A.F. WILDE, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4693)

To develop improved polymeric materials for transparent lightweight armor in aircraft and ground vehicles. Major thrust: survivability, aircraft and combat vehicles.

Further variations in composition, stoichiometry, and structure will be formulated with polyurethane block copolymer systems to improve applicability. Other types of phase-segregated transparent block copolymers will be synthesized for evaluation as ballistic protective materials. Selected promising new transparent polymers will be investigated as backing materials in glass-faced laminate systems. Various transparent adhesives will be evaluated as interlayers in laminates which contain polyurethane or other new materials as backup plates. Room-temperature ballistic testing will be accompanied by high- speed photography. Ballistic and optical properties of selected transparent polymers will be investigated over a range of temperatures. Deterioration studies will be performed with transparent armor materials.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0027, CASELESS AMMO TECHNOLOGY - SOLID PROPELLANT FLAMMABILITY
M. SUMMERFIELD, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DA0G4542; DAAD05-72-C-0135)

To develop generalized theoretical models describing flammability of solid propellants of various types in air, and in particular, to relate the flammability characteristics to measured physical, chemical, and ballistic properties of the propellant; to perform confirming experiments; to apply the theoretical methods to the evaluation of candidate propellants for the HITP/SEAP program of SASA; to provide reports on test methods suitable for practical application.

Break the flammability problem down into the following processes: the ignition event; retention of flame after removal of ignition stimulus; and flame spreading at ambient atmospheric conditions. Develop theories which can predict these events. Evaluate the validity of the theories thus developed by performing ignition tests, low pressure limit tests, and flame spreading tests; perform such diagnostic experiments as may be necessary to check the validity of the models adopted.

Supporting agency address information: AMC Ballistic Research Labs, Aberdeen PG, Md. 21005

SUPPORTED BY U.S. Dept. of Defense - Army

3.0028, SOLID PROPELLANT BURNING
M. SUMMERFIELD, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (N00014-67-A-0151-0023)

Description: The burning rate and flame structure of the cyclic nitramine propellants HMX and RDX, which have a desirable high impetus but also stability problems, will be obtained by solution of the conservation equations, including a new, detailed, realistic treatment of the chemical mechanism with no adjustable parameters. Experimental increases in burning rate pressure dependence in composite propellants will be compared with novel approximate analytical solutions for burning rate based on hypotheses including increased heat feedback due to merging of reaction zones at high pressures, or to diffusion-controlled flammability limits of multiple flames. The theoretical results will be tested by comparing with experimental flame temperatures and product mass fractions measured in our laboratories. Other experiments will be directed toward improving knowledge of input rate parameters and the nature of the melt layer. The theoretical nonsteady burning rate, similar to that derived by Zeldovich but including a more careful consideration of boundary conditions, is being derived also, based in part on the heat feedback obtained from our steady burning results. This work can directly suggest new approaches for reducing nitramine stable-burning problems.

Addenda: Estimated calendar year funding reported as 1974 $66,000, 1975 $66,000.

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0029, PREFERENTIAL REMOVAL OF A COMPONENT FROM A BINARY ALLOY
H. PICKERING, Penn. State University, School of Engineering, *University Park, Pennsylvania* 16802 (DMR73-02396 A01)

This research on corrosion is a basic study of the mechanisms of preferential removal of a component from an alloy. It is important in a wide variety of environmental conditions, ranging from electrolytic solutions at ambient temperature (aqueous) and at elevated temperatures (molten salts) to aggressive gases at high temperatures. Model systems (Co-Pt, Fe-Pt) will be studied at elevated temperatures in chlorine environments. The scale surface porosity will be studied as a function of chlorine partial pressure, Pt content of the alloy, temperature, grain size and microstructure, and time at temperature. Weight loss measurements and microstructural examination will be made to follow the corrosion process. The role of chlorine partial pressure in determining the onset of surface roughening will be assessed. A theoretical analysis will be made of the mass transfer processes in the alloys, with special emphasis on elucidating the expected rate law when surface roughening occurs.

This research was previously supported under DMR-7302396.

SUPPORTED BY U.S. Natl. Science Foundation

3.0030, HT PP 75-20- SUCTION FUEL CONTAMINATION TEST
A.S. MYSINEK, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0D3962)

To determine if the suction fuel system, as proposed on the Utility Tactical Transport Aircraft System (UTTAS), poses potential problems in regard to contaminant ingestion.

A. Design and fabricate a mock-up of proposed UTTAS suction fuel system. B. Conduct tests to determine the following: (1) size/density of contaminates subject to suction; (2) quantity of contaminants subject to suction/unit time. C. Conduct a cursory analysis to determine the adverse effects of contaminants ingested into fuel control. Determine filtration requirements.

Supporting agency address information: AVSCOM Air Mobility R&D Lab, Eustis Directorate, Ft. Eustis, Va. 23604

SUPPORTED BY U.S. Dept. of Defense - Army

3.0031, HT 69-2- BALLISTIC RANGE OPERATION & GENERAL MAINTENANCE
E.M. PARD, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0B4016)

To operate, maintain, and provide instrumentation to support the ballistic testing of experimentally designed and fabricated concepts that are intended to increase the survivability of Army aircraft.

Provide continuous ballistic/instrumenttion support for in-house contractural efforts. Ballistic support is provided in conjunction with developing, testing, and evaluating experimmental materials and systems that increase the survivability of Army aircrews aircraft.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft. Eustis, Va. 23604

SUPPORTED BY U.S. Dept. of Defense - Army

3.0032, HT 74-14- BALLISTIC TESTING, ARMY AIRCREW AND CRITICAL COMPONENT PROTECTIVE DEVICES
C.M. PEDRIANI, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0D3912)

To provide ballistic testing of critical component and aircrew protective devices and to validate design criteria that increase the ballistic survivability of Army aircraft.

To conduct experimental firing programs in conjunction with design, fabrication, and ballistic test to evaluate: (1) fuel fog inerting concepts to reduce inflight fuel fires in helicopters; (2) fuel tank materials to increase the survivability of the AH-1G to 14.5mm API projectiles; (3) fuel tank materials to increase the survivability of the AH-1g to 23mm HEI projectiles; (4) ballistic tolerant drive shafts/aircrew transparent opaque armor upgrade; (5) support of other area missions e.g., aircraft structures and flight controls; (6) miscellaneous support (e.g.,) installation, test, and evaluation of UTTAS HLH.

Supporting agency address information: AVSCOM Air Mobility R&D Lab. Eustis Directorate, Ft Eustis, Va. 23604

SUPPORTED BY U.S. Dept. of Defense - Army

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, FLUIDIC SUPPORTING TECHNOLOGY/REAL TIME RELIABILITY
D.J. SCHAFFER, Signal Companies Incorporated, *Phoenix, Arizona* 85034 (DA0D5755; DAAG39-72-C-0092)

To obtain real-time reliability for fluidic systems.

Failures and other pertinent information from laboratory and experimental flight tests will be recoded by the contractor for a number of fluidic systems manufactured by him. Active monitoring of fielded fluididc systems will also be included. The work is coordinated through the government fluidics coordination group which supplements the effort and assists in planning.

Supporting agency address information: AMC Harry Diamond Laboratories, 2800 Powder Mill Road, Adelphi, Md. 20783

SUPPORTED BY U.S. Dept. of Defense - Army

4.0002, SUPERCONDUCTING WEAK LINKS FOR MIXING AT MILLIMETER-WAVE FREQUENCIES 11796-EL

T. VANDUZER, Univ. of California, School of Engineering, *Berkeley, California* 94720 (DA0D9122; DA-ARO(D)-31-124-73-G165)

To deveop an improved technique for the fabrication of superconducting links and to study their properties at millimeterwave frequencies. Relevance: The primary application of superconducting electronic devices will be in ground terminals for military satellite communication. In addition, superconducting electronics represents an important application potential for general microwave generation, detection, mixing and amplification. The ECOM has an active interest in this area.

Investigations will be made on indium and vanadium superconducting constrictions at X-band, 72 GHz and 300 GHz frequencies. A computer controlled scanning electron microscope will be used for fabrication. Sensitivity, noise properties, speed of response and impedance matching will be investigated and optimized.

Supporting agency address information: AMC Army Research Office (ARO-D), Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

4.0003, RESEARCH ON WALL TURBULENCE 11170-E

R.F. BLACKWELDER, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (DA0D9086; DA-ARO(D)-31-124-73-G118)

To investigate the phenomena of turbulent bursts which are known to occur near the wall in bounded turbulent shear flows. Relevance: the results of this investigation are important to the understanding of turbulent boundary layer development in both steady and unsteady flow and therefore will contribute to research currently underway at EBL, Aberdeen Proving Ground and the Army's helicopter and V/STOL Aircraft Designs, i.e., blade vortex shedding and stabilizer controls.

Information will be obtained on both the streamwise velocity and the normal velocity of the flow, conditionally average the normal velocity component as well as the Reynolds stress during the burst occurrence and when there is no bursting activity, as well as decay of the burst.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

4.0004, ROUGHNESS EFFECTS ON SUPERSONIC TURBULENT BOUNDARY LAYERS 12398-E

T. UBOTA, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (DA0D9259; DAHC04-74-C-0009)

To conduct an experimental investigation at Mach 3 and Mach 6 of the roughness effects on supersonic turbulent boundary layers. Relevance: This research will contribute directly to the determination of drag for projectiles and missiles under development at BRL, indirectly to the turbulent boundary layer structure problems in project 'FUMER' at BRL, and will provide research assistance to the MICOM missile research programs on ground-to-air operations.

Problems to be studied are: (a) the effect of abrupt change in surface roughness, smooth to rough, and rough to smooth, and (b) the effect of roughness height and spacings.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

4.0005, RESEARCH IN RADIATION PHYSICS AND AERODYNAMICS - LASER DIAGNOSTICS AND INTERACTIONS 10757-P

A.T. ELLIS, Univ. of California, School of Engineering, *San Diego, California* 92038 (DA0D9023; DAHC04-72-C-0037)

To increase the understanding of laser diagnostics and interactions. The Institute for Pure and Applied Science at the University of California (San Diego), is an interdisciplinary group of scientists carrying out experimental and theoretical research related to defense aspects of gas physics, plasma phenomena, and turbulent flows. Research in lasers with a potential for diagnostics and weapon applications is also included. The major applications for this research to strategic technology are: reentry discrimination and countermeasures, laser techniques and applications, and ionospheric plasma dynamics (OHD).

Development of laser diagnostic techniques and investigations of non-linear interactions shall be performed.

Supporting agency address information: AMC Research Office, Durham, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

4.0006, RESEARCH IN RADIATION PHYSICS AND AERODYNAMICS, TURBULENT MIXING AND SHEAR FLOWS 10757-P

C.H. GIBSON, Univ. of California, Graduate School, *San Diego, California* 92038 (DA0D9019; DAHC04-72-C-0037)

To increase the understanding of turbulent mixing and shear flows. The Institute for Pure and Applied Science at the University of California (San Diego), is an interdisciplinary group of scientists carrying out experimental and theoretical research related to defense aspects of gas physics, plasma phenomena, and turbulent flows. Research in lasers with a potential for diagnostics and weapon applications is also included. The major applications for this research to strategic technology are: reentry discrimination and countermeasures, laser techniques and applications and ionospheric plasma dynamics (OHD).

Basic studies of turbulent mixing and shear flows shall be performed.

Supporting agency address information: AMC Research Office Durham, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

4.0007, RESEARCH IN RADIATION PHYSICS AND AERODYNAMICS - WAKE TURBULENCE AND ATMOSPHERIC BOUNDARY LAYERS 10757-P

S.C. LIN, Univ. of California, School of Engineering, *San Diego, California* 92038 (DA0D9018; DAHC04-72-C-0037)

To increase the understanding of wake turbulence and atmospheric boundary layers. The Institute for Pure and Applied Science at the University of California (San Diego), is an interdisciplinary group of scientists carrying out experimental and theoretical research related to defense aspects of gas physics, plasma phenomena, and turbulent flows. Research in lasers with a potential for diagnostics and weapon applications is also included. The major applications for this research to strategic technology are: reentry discrimination and countermeasures, laser techniques and applications, and ionospheric plasma dynamics (OHD).

Experimental and theoretical studies shall be conducted involving variable temperature effects, entrainment, mixing, chemical reactions in both wake turbulence and atmospheric boundary layer as appropriate, and also turbulence in stratified flows.

Supporting agency address information: AMC Research Office Durham, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

4.0008, RESEARCH IN RADIATION PHYSICS AND AERODYNAMICS- HIGH-TEMPERATURE GAS DYNAMICS 10757-P

S.E. MILLER, Univ. of California, Graduate School, *San Diego, California* 92038 (DA0D9020; DAHC04-72-C-0037)

To increase the understanding of high-temperature gas dynamics. The Institute for Pure and Applied Science at the

University of California (San Diego), is an interdisciplinary group of scientists carrying out experimental and theoretical research related to defense aspects of gas physics, plasma phenomena, and turbulent flows, research in lasers with a potential for diagnostics and weapon applications is also included. The major applications for this research to strategic technology are: reentry discrimination and countermeasures, laser techniques and applications and ionospheric plasma dynamics (OHD).

Basic gas dynamics research involving radiation, chemical reactions, kinetics, and turbulence shall be performed.

Supporting agency address information: AMC Research Office, Durham, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

4.0009, ATMOSPHERIC TRANSFER AND SHIELDING PROPERTIES IN THE 50 TO 75 GHZ BAND 12233-GS

H.J. LIEBE, U.S. Dept. of Commerce, Inst. For Telecomm. Science, *Boulder, Colorado* 80302 (DA0E8922)

To conduct a comprehensive experimental and analytical study of the atmospheric microwave spectrum of oxygen (O sub 2-ms) to provide reliable data on the spectroscopic parameter of O sub 2 within the frequency range of approximately 50 to 75 GHz. The availability of reliable atmospheric propagation data for millimeter waves is essential for planning of fture army communication, navigation, radar and meteorological satellite radiometric systems. USAECOM has a 65 GHz communication link under exploratory development.

The approach involves laboratory measurements covering the full range of meteorological variables from the surface to 100 km altitude. A computer-controlled pressure-scanning spectrometer will be used for obtaining the intensity distribution (attenuation, dispersion) of the oxygen microwave spectrum. Analytical approaches also are necessary for the prediction of the shielding and transfer properties of the earth's atmosphere.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

4.0010, PHOTODETACHMENT STUDIES OF MOLECULAR NEGATIVE IONS 11892-P

E.C. BEATY, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (DA0D9183; DAHC04-75-G-0024)

Study the photodissociation and photodetachment of negative ions of No sub 2, No sub 3, Co sub 3, Co sub 4 and their hydrates. Photodetachment cross sections for negative atmospheric ions are needed to compute free electron density which affect: ionospheric communication systems (VLF, LF, MF, and HF); ionospheric detection systems (Early Bird Warning System); and nuclear detonation residual effects on the atmosphere.

I. Ions produced in a relatively high pressure discharge will be allowed to reach thermal equilibrium in a vibrational sense, illuminated with a dye laser beam, and then be admitted to a quadrupole mass spectrometer for analysis. II. A relatively low pressure ion source will inject ions into a high vacuum chamber in which they are illuminated with a laser beam. Both neutral and charged fragments resulting from photodetachment or photodissociation will be detected.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Durham, NC 28206

SUPPORTED BY U.S. Dept. of Defense - Army

4.0011, AN INVESTIGATION OF STRESS-STRAIN HISTORY MODELING AT STRESS RISERS

J. CARROLL, Lockheed Georgia Company, *Marietta, Georgia* 30060 (DF134900; F33615-75-C-3078)

The occurrences of fatigue cracks in tactical and strategic aircraft structures degrade structure strength, increase life cycle costs and impair fleet readiness. This program will be directed to development of a model to depict the stress-strain behavior that occurs at stress risers in aircraft structures. The development of an accurate model is essential for assessing fatigue crack initiation and to enable the design of future structures to resist crack initiation.

An experimental and analytical effort to model stress-strain behavior at stress risers is to be conducted in two phases. Phase I effort will investigate the adequacy of the selected experimental techniques and existence of meaningful variations in plastic strains at stress risers. Phase II effort to be undertaken if Phase I is successfully completed, will include the collection of a data base and the development of a stress-strain behavior model at stress risers.

Supporting agency address information: AF Flight Dynamics Laboratory, FBE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0012, FATIGUE BEHAVIOR OF STRINGERS IN STIFFENED PANELS

A. SALVETTI, Univ. of Pisa, *Pisa, Italy* (DA0C9327; DA ERO 124 74 G0042)

This is a continuation of previous efforts reported under DA0B 9361 and 94019.

This effort is aimed at determining the influence of the position of the crack propogation line with respect to rivet holes on the crack length lambda in the sheet, at which a crack starts in the stiffener, and the fatigue stress concentration factor kf. Also, the influence of the various types of riveted connections normally found in aircraft construction of KF will be determined.

Supporting agency address information: AMC R&D Group-Europe, Box 15, FPO NY 09510

SUPPORTED BY U.S. Dept. of Defense - Army

4.0013, X-RAY - SHELL RESPONSE

N.J. HUFFINGTON, U.S. Army, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0G4436)

In the analysis of nuclear weapons effects on reentry vehicles and ABM materiel, one must be able to predict not only the occurrence but also the extent of induced structural damage. For this reason the structural response analyses must be of sufficient generality to include the nonlinear effects of large deflections and of elastoplastic material behavior. The extent of structural damage induced by large deflection will provide a basis for defining and establishing kill criteria. The objective is to provide a validated analytical tool for performing such calculations.

It is planned to complete the documentation of both the theoretical basis and user's information for the BRL-developed repsil code which meets these requirements. Additional comparisons between REPSIL code results and those obtained with a similar contractor-produced code (PETROS II) are planned with the objective of achieving an optimized formulation for response predictions. Additionally, when received from the contractor, the PETROS III code will be adapted and evaluated. This latter code has added capability for treating multilayer, multi-material shells and for simulating thermal effects. These analytical developments are to be coordinated with experimental investigations, both to check the validity of the analysis and to gain insight into the significance of various parameters with a view to making worthwhile simplifications of the model.

Supporting agency address information: AMC Ballistic Research Labs, Aberdeen PG, Md. 21005

SUPPORTED BY U.S. Dept. of Defense - Army

4.0014, TRANSONIC FLOW IN NOZZLES

J. POLK, U.S. Army, Ballistic Research Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0H4468)

To establish a numerical method for the computation of the transonic parts of flows in supersonic nozzles. Data furnished by such computations are necessary for quantitative analysis of rocket motor performance.

Literature will be searched for methods and/or codes for the computation of transonic nozzle flow. If reliable computation methods can be obtained for symmetric flows, an attempt will be made to model a three deimnsional transonic flow through a symmetric nozzle.

Supporting agency address information: AMC Aberdeen R&D Center, Aberdeen PG, Md. 21005

SUPPORTED BY U.S. Dept. of Defense - Army

4.0015, FLUIDIC AMPLIFICATION AND SENSING
J.M. KIRSHNER, U.S. Army, Fluidic Systems Res. Branch, *Hyattsville, Maryland* 20783 (DA0B5631)

To determine the factors affecting flueric amplifiers and to develop design theories; to examine methods of fluerically measuring temperature, velocity acceleration, angular velocity and acceleration, the presence or absence of objects, etc.

The analyses of the various types of amplifiers are being improved to meet particular system requirements for use in new Army materiel concepts. The laminar proportional amplifier is being studied to reduce bias sensitivity, increase input impedance and staging to obtain a satisfactory operational amplifier. A vortex rate sensor trade-off study is being made.

Supporting agency address information: AMC HDL Fluidics Systems Research Branch, 2800 Powder Mill Road, Adelphi, Md. 20783

SUPPORTED BY U.S. Dept. of Defense - Army

4.0016, ELECTRICAL INJECTION SIMULATION OF SGEMP ON SKYNET
J. ROSADO, U.S. Army, Harry Diamond Laboratories, *Hyattsville, Maryland* 20783 (DA0E5804)

The objective of this program is to perform a set of electrical current injection experiments on the Skynet satellite and compare the results with analytical predictions. The experiments will be designed to simulate various aspects of the System-Generated Electromagnetic Pulse (SGEMP) on a satellite structure complete with interface circuits (passive).

A set of analytical predictions was generated to relate the electrical pulse injection to the photon illumination SGEMP problem. basically structural and surface currents have been predicted for a set of specified external current injection methods. The major portion of this program is devoted toward performing a meaningful current injection experiment on Skynet and to measure the response of the satellite.

Supporting agency address information: AMC Harry Diamond Laboratories, AMXDO-RBI, 2800 Powder mill Road, Adelphi, Md. 20783

SUPPORTED BY U.S. Dept. of Defense - Army

4.0017, SYSTEM TEST PLAN FOR THE AUTOMATIC INTERSECTION CONTROLLER TEST BED
UNKNOWN, S. Ross & Company, *Boston, Massachusetts* 02109 (058208 (TRAIS NO.))

Five objectives of the field test plan are: a. Document the effectiveness of the AIC System to monitor, signal and control traffic through an intersection. b. Document a base-line performance level for the surveillance technique evaluation test bed. c. Evaluate the relative performance of visual ground aid equipment. d. Evaluate the effectiveness of visual communication systems, as a method to relieve the present voice communication system. e. Document the physical characteristics required to expand the intersection controller into an airport-wide automatic control system.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

4.0018, MECHANICAL STUDIES OF COMPOSITE JOINTS
D. OPLINGER, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4738)

This effort is relevant to RDT E thrust G-2 'Survivability/Aircraft Combat Vehicles.' The aim of this work is to provide improved understanding of design requirements of joints in composite structures. Specific attention will be given to effects of layered structure, nonlinear response and failure modes arising at joints. Joint design is a critical factor in achieving performance, lifetime and weight objectives in applications of composites under consideration such as helicopter rotor blades, aircraft fuselage components, manportable antitank weapons and other fiber-reinforced hardware components. This effort is also relevant to pacing problem No. 22 'Design and Analysis Techniques for Fiber-Reinforced Structures.'

FY76 efforts will include continuation of FY75 analytical and experimental studies of mechanical and adhesive joints with emphasis on confirming analytical predictions related to optimum design of composite joints. Experimental studies will include experimental strain analysis studies (moire and holography) and strength measurement on selected geometric configurations, both in bolted and adhesive bonded joints. Effort will be initiated on application of fracture mechanics approaches to composite joints.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

4.0019, STRUCTURAL PROPERTIES OF BALLISTICALLY TOLERANT MATERIALS
J. PLUMER, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4774)

Current aircraft fuselage construction, a shim supported by stringers and frames, is inadequate under foreseeable threats of mid- intensity warfare, such as 23mm HEI shells, SA-F missiles and high energy lasers, each with the capability of destroying substantial portions of this construction with a single hit. The project objective is the assessment and development of damage tolerance of composite panel materials suitable for a monocoque fuselage construction. High explosive generated structural damage is greatly reduced in this design as all aerodynamic loads are carried in the skin, plus monocoque construction avoids the thin skins susceptibility to rapid laser burn-through.

Panel sections will be fabricated in various designs embodying combinations of fiber reinforced skin and core materials in selected configurations. These panels will be subjected to damage by projectiles, by high explosive shell and by high intensity radiation. The nature of damage will be determined and degradation of structural properties measured. Through analysis of test data, design criteria for composite panel materials tolerant of such damage will be established. Radar- return characteristics of the materials will also be determined.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

4.0020, STUDIES IN ROTATIONAL FLOWS, ESPECIALLY ASYMPTOTIC METHODS 12373-M
G.S. LUDFORD, Cornell University, School of Engineering, *Ithaca, New York* 14850 (DA0E8974; DAHC04-75-G-0016)

Develop mathematical techniques for deducing physically realistic solutions in fluid mechanics with special stress on rotational flow problems. Development of rigorous mathematical tools for the study of dynamics of rotating fluids has considerable relevance to the Exterior Ballistics Laboratory at BRL and Army Aerodynamic Research. Specifically, this study may enhance our understanding of the performance of projectiles and missiles, in particular the influence of free boundary layers on the internal motion of payloads.

The method of matched asymptotic expansions with or without a turning point.

Supporting agency address information: AMC Army Research Office, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

4.0021, TURBULENT BOUNDARY-LAYER ON SPINNING BODIES OF REVOLUTION 12675-E
F. DEJARNETTE, Univ. of North Carolina, School of Engineering, *Raleigh, North Carolina* 27600 (DA0E8923; DAHC04-76-G-0004)

The scope of this investigation is the determination of a simplified analytical method for calculating the three-dimensional, turbulent boundary layer on a spinning body of revolution at an angle of attack to a uniform oncoming stream. Non-symmetry produced in the boundary layer on this spinning body is to be determined in order to calculate its effects on the Magnus force. For many years, Army scientists at both BRL and MICOM have been interested in developing an analysis method for predicting the Magnus forces which occurs on spinning missiles and projec-

tiles. These Magnus forces cause the projectile to become unstable along its flight path, creating large dispersions at the target area. Recently, this problem has been recognized to be caused by asymmetries in the turbulent boundary layer. The simplified method discussed in this proposal should allow Army engineers to quickly estimate the magnitude of this Magnus force and to provide suitable countermeasures.

A spinning circular cone will be analyzed, firstly for incompressible flow, utilizing existing methods for the laminar portions of the boundary layer and developing a momentum integral method for the turbulent portion of the boundary layer. The nonsymmetric distribution of the displacement thickness will be calculated in order to determine the subsequently produced side force (Magnus force). Velocity correlations required for the momentum integral method will be derived from the 'Law of the Wall' for the axial velocity component and from various holograph models for the transverse velocity component.

Supporting agency address information: AMC Army Research Office, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

4.0022, DEVELOPMENT OF A METHOD FOR COMPUTING SUBSONIC AND TRANSONIC SEPARATED FLOWS 12437-E

P.M. GERHART, Univ. of Akron, School of Engineering, *Akron, Ohio* 44304 (DA0E8973; DAHC04-75-G-0026)

To develop an analytical method for computation of subsonic and transonic separated flows which is both practical and reasonably accurate for determining force changes on the body due to separation effects. This project is directly relevant to the transonic experimental and analytical work being done at MICOM, to the work on separated flows in exterior ballistics at BRL, and to the Helicopter Research Program at AMRDL-Ames Directorate.

Based on the concept of dividing the flow field into viscous and inviscid regions. Several essential elements for a successful computation procedure for separating, separated, and reattaching subsonic turbulent flows will be tried utilizing the momentum and kinetic energy integral equations for the viscous flow and small-disturbance theory for the inviscid flow.

Supporting agency address information: AMC Army Research Office, Box CM, Duke Station, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

4.0023, RESEARCH ON ONE-DIMENSIONAL DISTRIBUTED SYSTEMS WITH PROFILE EFFECTS 9244-E

P.A. ORNER, Case Western Reserve Univ., School of Engineering, *Cleveland, Ohio* 44106 (DA0C9190; DA-ARO(D)-31-124-71-G26)

To analyze, simulate and design methodology for distributed systems which can be modelled by a certain class of functional differential equations. This research is directed to improved methods of analysis of fluidic systems such as are used in missile guidance, aircraft actuation systems and vehicle controls. It will also be applicable to hydraulic systems on board Army helicopters and other aircraft where high- performance optimization is important.

Three phases of research will be conducted: (1) analyzing and simulating aspects; (2) modelling to determine unknown parameters in functional-differential models; and (3) final designing phase with emphasis on computer-aided systems design of realistic systems.

Supporting agency address information: AMC Army Research Office (ARO-D), Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

4.0024, THE MECHANICS OF NEAR SURFACE INCLUSIONS AND THEIR EFFECT ON FATIGUE LIFE 10949-MC

P.H. FRANCIS, Southwest Research Institute, *San Antonio, Texas* 78228 (DA0D9076; DAHC04-73-C-0010)

To contribute to the technical knowledge in understanding the effect of near surface inclusions on the fatigue life of high strength material. Fatigue is an important mechanism of failure in many items of hardware such as gun tubes, rotating components of helicopters, and moving components of vehicles.

The research to be performed is to include, but will not be restricted to the following: (1) a selection is to be made from systems such as 4340 steel, aluminum-copper alloys, and/or titanium alloys, which contain various classes of inclusions, in order to characterize the size and configuration of typical inclusions in the material(s), and therefrom, to propose a refined model for initiation of cracks from such inclusions; (2) the chemical composition of the inclusions and of the adhesion characteristics of the inclusion/matrix interface are to be determined; (3) a theoretical determination is to be made of the extent of plastic deformation surrounding a shallow subsurface inclusion; (4) a theoretical analysis of the plastic stress/strain field near a surface inclusion is to be performed.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

4.0025, EXPERIMENTAL INVESTIGATION OF UNSTEADY SEPARATION 12680-E

D.P. TELIONIS, Virginia Polytechnic Institute, School of Engineering, *Blacksburg, Virginia* 24061 (DA0C5570; DAHC04-75-G-0067)

To investigate experimentally the flow properties in the neighborhood of separation within an unsteady boundary layer in an effort to verify the Sears-Telionis concept of unsteady separation. Relevance: The dynamic stall problem which occurs on the retreating blade of an advancing helicopter rotor can be explained in terms of an unsteady turbulent boundary layer separation. The description of this physical process is based on the Sears-Telionis unsteady separation concept. This concept is fundamental to all dynamic stall research work being carried out at AMRDL-Ames directorate.

A glycerin-water mixture will be used to yield low Reynolds numbers and thick boundary layers with reasonable velocities. Separation will be induced by time-dependent adverse pressure gradients. Hydrogen bubbles and ink dyes will be used for flow visualization.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

4.0026, HT 74-16- FIELD APPLICATION OF SONIC ANALYSIS

R.J. HUNTHAUSEN, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0D3935)

Further investigate the feasibility of applying acoustic acquisition and analysis techniques to inspect and diagnose the mechanical condition of helicopter engines, transmissions and gearboxes without disassembling or removing these components from the aircraft. Significant safety and maintenance benefits could be accrued from this work.

Analyze the acoustic signatures of two high time UH-1 helicopters whose engines and powertrain components are implanted with degraded gears and bearings. Data will be acquired on the ground at various rotor speeds via condenser microphones selectively positioned next to the aircraft. Frequencies approaching 100KHz will be recoverable.

Supporting agency address information: AVSCOM Air Mobility Research and Development Laboratory, Eustis Directorate, Ft Eustis, Va. 23604

SUPPORTED BY U.S. Dept. of Defense - Army

4.0027, HT72-2- ENGINEERING PROPERTIES OF MATERIALS, ARMY AIRCRAFT STRUCTURES

T.L. MAZZA, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0C4011)

To determine effects on the fatigue life of graphite-epoxy and fiberglass-epoxy. Information will serve as baseline data for in-house component fabrication, monitoring contractual programs and Army aviation materials/structures engineering efforts.

Specimens of graphite-epoxy and fiberglass-epoxy will be exposed to an outdoor environment. Specimens will be notched, unnotched, protected with ultraviolet and gel coatings and unprotected. All specimens will be transferred weekly to an indoor machine and cycled 20,000 cycles in bending at a fixed deflection. Modulus, tensile strength and void content will be determined before and after fatigue cycling.

Supporting agency address information: AVSCOM Air Mobility R & D Lab, Ft Eustis, Va. 23604

SUPPORTED BY U.S. Dept. of Defense - Army

4.0028, HT RM 75-15- EXPERIMENTAL INVESTIGATION OF THE MECHANICAL PROPERTIES OF ELASTOMERIC BEARINGS FOR ARMY AIRCRAFT

J.W. SOBCZAK, U.S. Army, Air Mobility Res. & Dev. Lab., *Newport News, Virginia* 23604 (DA0D3842)

The primary objective of this program is an investigation of the mechanical properties (static and dynamic spring rate) of elastomeric bearings in the temperature range 100 degrees F to minus 65 degrees F with primary emphasis on the low end of this range. Fatigue properties and ballistic tolerance will also be investigated. Data resulting from this program will support the development of a design manual for elastomeric bearings which will lend to improved R&M for future systems. It will also support climatic hangar testing of the 540 all Elastomeric Bearing Rotor System (AH-1 and UH-1 aircraft) and provide data for the design of improved systems for future Army aircraft.

An elastomeric bearing test specimen will be instrumented with implanted thermocouples which will enable internal temperatures to be monitored. The test bearing will then be mounted in a test fixture, placed into an environmental chamber and run down to a low temperature. Static spring rates will be checked initially. Next, the bearing will be cycled and dynamic spring rate and internal temperatures will be measured as a function of frequency and magnitude of angular oscillation.

Supporting agency address information: AVSCOM Air Mobility R&D Lab, Eustis Directorate, Ft Eustis, Va. 23604

SUPPORTED BY U.S. Dept. of Defense - Army

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production And Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, NOCTILUCENT CLOUD OBSERVATIONS COORDINATED WITH ROCKET TEMPERATURE SOUNDINGS IN CENTRAL ALASKA - II 12752-GS

WJ. STRINGER, Univ. of Alaska, Geophysical Institute, *Fairbanks, Alaska* 99701 (DA0E8968; DAHC04-75-G-0003)

To perform a series of measurements which have a bearing on current theories concerned with cooling of the mesopause (80 km), warming of the stratopause (50 km), and upward transport of water vapor. Observations of noctilucent clouds in coordination with temperature measurements will provide information on vertical atmospheric motions between 50 and 80 km. These motions in turn influence determination of temperature and density values in current atmospheric models which are used in calibration of meteorological satellite systems, in flight programming of large rockets, prediction of nuclear weapons effects, and in design of communication equipment.

To establish an observational site near Healy, Alaska, to photograph noctilucent clouds using a variety of cameras. Volunteer observations of noctilucent clouds in the areas will also be solicited. These observations will be coordinated with rocket temperature measurements from the Army Poker Flats, Alaska, Rocket Site.

Supporting agency address information: AMC Research Office, Durham, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

5.0002, APPLICATIONS OF AERIAL MEASUREMENTS TECHNIQUES

M.L. BROWN, U.S. Dept. of the Interior, Geological Survey, *Prescott, Arizona* 86301 (WR 89-118)

Application of techniques and equipment for airborne remote sensing to hydrologic problems, such as floods, industrial or natural pollution, streamflow characteristics, dynamics of lakes and estuaries, ice packs, and urbanization of watersheds. Techniques include side-looking airborne radar, multi-spectral sensing, infrared imagery, aerial photography, thermal imagery.

Sophisticated techniques and instrumentation for airborne remote sensing of hydrology have been developed through a WRD research program and demonstrated in actual use. This project is to provide data collection services on a reimbursable basis to WRD districts, other divisions within the survey and other federal agencies by applying the techniques that have been developed. Techniques include side-looking airborne radar, multi-spectral sensing, infrared imagery, aerial photography, thermal imagery. Support will be provided as required to the developmental program.

Information will be circulated to regional and district offices concerning the services available and their costs, and requests for data will be solicited. Data collection will be scheduled in accordance with requirements of requestors. The data product will primarily be in the form of film records.

Reimbursible services to provide hydrologic data to WRD districts.

It is planned to disseminate through regional and district offices, information concerning the airborne data collection capabilities of the unit to promote greater utilization of the services available.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0003, DEVELOPMENT OF AERIAL MEASUREMENT TECHNIQUES

H.E. SKIBITZKE, U.S. Dept. of the Interior, Geological Survey, *Prescott, Arizona* 86301 (WR 89-117)

Development of aerial measurement techniques to be applied to hydrologic problems, such as floods, industrial or natural pollution, streamflow characteristics, dynamics of lakes and estuaries, ice packs, and urbanization of watersheds.

The research effort for development of remote sensing techniques has successfully produced sophisticated methods and equipment. Research is not required at this point. Rather, a developmental program is required in the applications of techniques resulting from the research effort, in the training of others in applications of techniques, and in the utilization of the data acquired.

Provide training for techniques in the maintenance and use of remote sensing equipment; for scientists and technicians in the utilization of data; and advise division, regional and district leaders on the availability and usability of remote sensing data; complete a handbook (manual) on remote sensing (in progress); acquire very fine, sophisticated remote sensing equipment from military sources and adapt it to the needs of the hydrologic data collection program; develop a program of real-time remote sensing. Techniques include aerial photography, side-looking airborne radar, infrared and thermal imagery, multispectral imagery.

Airborne remote-sensing techniques using side-looking airborne radar.

Continued development and refinement of techniques for airborne collection of hydrologic data are planned. Back-up equipment is being prepared to reduce down-time caused by maintenance of operating instrument. Modification of the cryogenics system for cooling of detectors is planned. Ground stations will be prepared to receive telemetered data for real-time readout of imaged data. Orientation of WRD personnel in collection and use of data are planned.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0004, QUATERNARY SEDIMENTATION AT THE MARINE-FLUVIAL INTERFACE, SOUTHWESTERN OREGON

R.J. JANDA, U.S. Dept. of the Interior, Geological Survey, *Menlo Park, California* 94025 (WR 00-045)

Quaternary tectonism and glacio-eustatic fluctuations of sea-level have profoundly influenced landscape development and patterns of coastal sedimentation in southwestern oregon. Understanding these historical influences, as well as modern seismicity, erosion and sedimentation, will aid the systematic development of the evolving fisheries--forest products--tourism economy of the area.

(1) To understand the depositional processes and history of potentially important placer deposits, aquifers, and other sediments underlying the coastal plain of southwestern oregon. (2) To use geologic techniques to put limits on long-term rates of erosion and to compare those rates with rates computed from stream discharge and water quality data. (3) To evaluate the influence of changing baselevel on landscape evolution in bedrock terrains of contrasting erosional resistance. (4) To evaluate tectonically deformed landforms and sediments in terms of potential seismic hazards.

Establish gage sites to determine water, suspended sediment, and solute discharge. Compute modern denudation rates by combining measurements of suspended and chemical loads and Meyer-Peter, Muller calculations of bedload; compare these rates with volumes of material eroded from beneath reconstructed landforms of known age. Study coastal sediment dispersal using mineralogy, primary sedimentary structures, and a variety of remote sensing tools including high altitude (RB-57) photography and ERTS-imagery. Make repeated observations of changing geometry of river channels, estuaries, beaches and seacliffs. Detailed mapping and petrographic study of surficial sediments and soils. Obtain onshore and offshore data from drilling logs and seismic reflection and refraction surveys.

New paleontologic data and radiometric dates allow more precise ages to be determined.

Complete mapping at scale of 1:24,000; compile all field data; complete first draft of final report on stratigraphic aspects of study; continue studies of dispersal patterns of particulate matter in nearshore waters using ERTS MSS imagery and surface drifters.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0005, RECONNAISSANCE OF BANK STORAGE POTENTIAL

W.D. SIMONS, U.S. Dept. of the Interior, Geological Survey, *Menlo Park, California* 94025 (WR 00-041)

A significant amount of bank storage at hungry horse reservoir was demonstrated in previous studies. Currently there are more than 150 reservoirs with over 30 million acre-feet of storage in the Columbia North Pacific Region. Bank storage may also exist in significant amounts in some of these reservoirs. Which of these reservoirs has the largest potential amount of bank storage? and how is it available for augmenting the outflow from associated reservoirs?

The basic objectives of this study are to identify those reservoirs in the Columbia North Pacific Region that might have significant amounts of bank storage and to develop a sequence for further, and more detailed studies.

A basic inventory of reservoirs in Columbia North Pacific Region will be reviewed based on personal knowledge of the region and the readily available data such as: records of streamflow; changes in reservoir stage and storage; geologic data, fluctuations of groundwater levels adjacent to reservoirs; etc. A preliminary evaluation of bank storage potential will be periodically made for selected reservoirs employing the techniques used in the Hungry Horse investigations. This will be used to select other reservoirs for more comprehensive evaluation of bank storage characteristics by computer techniques and/or intensive field investigation.

Water-budget data for F.D. Roosevelt Lake was recomputed and compared with results of model studies. The trends indicated by both methods are complementary but a difference in seasonal values is indicated. Data from the 'deep' observation wells drilled last year will help refine final values of bank storage. Aerial photos were also obtained in connection with a related study to verify or revise the capacity table. Additional infrared imagery was obtained during 1974 power year when the reservoir was drawn down to elevation 1160. Infrared flights were also obtained at 4 other locations in pacific northwest and data were recorded by a 'wet chemical' process and on magnetic tape.

The difference in seasonal values for the bank storage volumes will be resolved for F.D. Roosevelt Lake and a draft of the final report prepared. In addition, studies will be required to make the maximum use of the infrared data collected at the other locations in the basin.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0006, CONSTRUCTION OF A BALLOON-BORNE LIQUID HELIUM COOLED SPECTROMETER SYSTEM

D. MURCRAY, Univ. of Denver, School of Arts & Sciences, *Denver, Colorado* 80210 (DA0H4562; DAAD05-72-C-0364)

To make accurate, simultaneous measurements of selected minor constitutents (e.g., H2O, HNO3, O3, NO2, NO) over the altitude range surface to 40 km.

An ultrasensitive balloon-borne infrared spectral radiometer will obtain moderately high resolution spectra of atmospheric thermal emission. These spectra will then be analyzed to obtain mixing ratio profiles of the above mentioned molecules.

Supporting agency address information: AMC Ballistic Research Labs, Aberdeen PG, Md. 21005

SUPPORTED BY U.S. Dept. of Defense - Army

5.0007, DEVELOPMENT OF LASER CROSS-BEAM PHOTON-CORRELATION SPECTROSCOPY FOR ATMOSPHERIC REMOTE SENSING 11876-GS

C.Y. SHE, Colorado State University, School of Natural Sciences, *Fort Collins, Colorado* 80521 (DA0D9284; DAHC04-74-G-0141)

To develop new techniques for determining atmospheric motions. This capability is the highest priority in the atmospheric sciences laboratory program for developing an automated meteorological system; it would make possible substantial improvement in artillery accuracy. In a longer range view, the research may also lead to remote sensing of turbulence, temperature, humidity, and particulate concentration and size, and be important to a number of military concerns, including microwave communications, laser systems used in the ambient atmosphere and prediction of mesoscale weather. Three Army laboratories have programs which will benefit from this work.

An experimental and theoretical program will be conducted to investigate and develop the technique of laser cross-beam-photon- correlation spectroscopy for the remote measurement of both laminar and turbulent flows under different temperature and moisture conditions. After successful completion of the laboratory work, field testing from the laboratory will be conducted and, if warranted, an airborne system will be constructed.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

5.0008, REMOTE SENSING RESEARCH IN WETLANDS

V.P. CARTER, U.S. Dept. of the Interior, Geological Survey, *Washington, District of Columbia* 20242 (WD 61-075)

Wetlands are an essential element in estmarine and riverrine productivity. They are hydrologically active areas of water storage and discharge, sediment and nutrient filtration, and erosional buffering. More information is needed on the spectroradiometric characteristics of wetlands vegetation for correlation with remote sensing data for delineation and identification of species and boundaries. Information is also needed on the seasonal and long term aspects of vegetational succession in wetlands, particularly as affected by heavy flooding, changes in salinity, sediment build-up and drainage and land use effects.

To determine the radiometric characteristics of wetlands vegetation in relation to interpretation of photographic data. To examine seasonal and long term succession in marshes as related to changes in salinity or other environmental parameters, especially those affected by changing land use. To determine the effects of drastic flooding on seasonal succession in marshes. To relate physical parameters with vegetation distribution in the wetlands ecosystem.

Project on seasonal succession in fresh water marshes has been completed and a report is being prepared. Spectroradiometric studies of wetland vegetation are continuing. Participation in a

congressionally authorized study of the Great Dismal Swamp, Va/N C has begun. An ERTS-1 study of wetland ecology in cooperation with American University has begun.

(Wetlands ecology) (a) wetlands contract (LKB) has as its objectives to: (1) continue spectroradiometric studies of wetland vegetation; prepare report on seasonal succession in fresh water marshes; (3) continue Dismal Swamp study; (4) continue ERTS-1 project on wetland ecology; (5) begin Skylab study of wetland ecology in cooperation with American University; and (6) prepare reports on wetland research.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0009, ALTITUDE DISTRIBUTION OF TRACE CONSTITUENTS AS DETERMINED FROM INFRARED SPECTRA
H.R. COPPERMAN, U.S. Natl. Science Foundation, *Washington, District of Columbia* 20550 (036844 (TRAIS NO.))

Provide data on the altitude distribution of trace constituents as determined from infrared spectra in the 1-28 micron region. Design and fabricate an infrared spectrometer.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

5.0010, TURBULENCE AND AEROSOL INVESTIGATION IN THE LOWER ATMOSPHERE
R. REITER, Physical Bioclimatic Res. Inst, *Garmisch Partenkirchen, Federal Republic of Germany* (DA0C9316; DAERO 75 G0077)

To investigate turbulence and aerosol behavior in the lower atmosphere.

To continue this study in the Garmisch Valley utilizing the expertise and laboratory and field instrumentation of Dr. Reiter and his laboratory staff.

Supporting agency address information: AMC R&D Group - Europe, Box 15, FPO NY 09510

SUPPORTED BY U.S. Dept. of Defense - Army

5.0011, LIGHT SCATTERING FROM IRREGULAR DIELECTRIC PARTICLES 12178-GS
G.D. WARD, State University of Fla. Sys., School of Engineering, *Gainesville, Florida* 32601 (DA0E5579; DAHC04-75-G-0100)

An experimental program for measuring scattering from irregular particles whose dimensions are comparable to the incident wavelength is planned to test theoretical solutions already developed. The inverse problem of determing particle shape from scattering data also will be explored. Relevance: the results will have direct application to the ECOM Ground Target Signature Program, the design of laser systems, and in the development of atmospheric remote sensing techniques for probing of cloud microstructure and radiation exchange in the atmospheric relevant to prediction of cloud and fog formation and dissipation.

The first test of the theory will be based on measurements of optical scattering from a single tumbled particle using a differential II photometer. Scattering intensity as a function of wavelength and angle will be recorded. More complex measurements using a differential (polar) nephelometer which contains two tunable optical sources with output from 360 nm to 1000 nm will then be pursued. Measurement of scattering from various shaped and oriented particles will be made.

Supporting agency address information: AMC Army Research Office, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

5.0012, PREDICTION AND REDUCTION OF THE NOISE IMPACT WITHIN AND ADJACENT TO ARMY FACILITIES
P.D. SCHOMER, U.S. Army, Construction Engin. Res. Lab., *Champaign, Illinois* 61820 (DA0E8132)

To develop methods to quantitatively predict the noise pollution impact of army operations, including blasting, helicopter operations, industrial plants, and transportation, on civilian and military populations, and to develop and assess means to reduce the noise impact of such operations.

In conjunction with other Army and governmental agencies such as the Environmental Protection Agency, the means to predict the noise impact of Army activities and/or facilities will be created and tested. The prediction will be a composite of all noise sources and will form 'equal noisiness' contours which can be overlayed upon land use maps to graphically expose incompatible zones. Based upon the predictions, operational and physical means to reduce the noise impact will be considered and evaluated for cost, effect upon Army operations, and effectiveness in noise mitigation.

Supporting agency address information: OCE Construction Engineering Res Lab, Champaign, Il. 61820

SUPPORTED BY U.S. Dept. of Defense - Army

5.0013, THE COALESCENCE OF WATER DROPS
Z. LEVIN, Tel Aviv University, *Tel Aviv, Israel* (DA0B9451; DA ERO 124 74 G0058)

To conduct study of factors affecting coalescence of water drops, and to evaluate the coalescence efficiency of colliding drops.

Undertake laboratory experimentation of coalescence of pairs of waterdrops of different (equals/r) ratios after collision and the effect of collision angle, surface tension, electric field and electric charge on the mechanism. Relevant to methods of fog/cloud modification research of Army, and to study of atmospheric effects on propagation of laser beams and other military uses of electromagnetic radiation.

Supporting agency address information: AMC Research and Development Group (Eur), Box 15, FPO NY 09510

SUPPORTED BY U.S. Dept. of Defense - Army

5.0014, DEVELOPMENT OF TECHNIQUES FOR DETERMINING DENSITY WIND PROFILES OVER SILENT AREAS FROM SATELLITE INFRARED OBSERVATIONS
G. OHRING, Tel Aviv University, *Tel Aviv, Israel* (DA0B9453; DA ERO 126 74 G0057)

Project will evaluate feasibility of deriving atmospheric density and wind profile for silent areas directly from satellite measured earth atmospheric infrared emission spectra.

Approach, utilize statistical technique based upon the derivation of specification equations relating atmospheric densities and wind to satellite spectra. The satellite spectra can be either the IRIS (Infrared Interferometer Spectrometer) or the SIRS (Scanning Infrared Spectrometer) data. Highly relevant to: mission and internal research of Desert Test Center and Atmospheric Research Lab (WSMR) for 'silent areas' in which only satellite data are available; prediction of nuclear fallout; artillery and rocket firings; and global weather prediction models.

Supporting agency address information: AMC R&D Group - Europe Box 15, FPO NY 09510

SUPPORTED BY U.S. Dept. of Defense - Army

5.0015, DELINEATION OF MAJOR SOIL BOUNDARIES IN KANSAS BY USING REMOTE SENSING TECHNIQUES AND AERIAL PHOTOGRAPHY
R.R. BEIGE, State Highway Commission, *Topeka, Kansas* 66612 (108898 (HRB NO.))

Determination is being made of: (1) what combination of photography and imagery can be used to distinguish various soils and materials, (2) if the costs for work can be justified, and (3) the best combination of photography for Kansas. The flying phase is completed. Data are under study. A ground base radiometer survey has been conducted on select sites in southeast Kansas to check the accuracy of the system in detecting subsurface voids such as mined-out areas. Publication: Soil identification by remote sensing techniques in Kansas, Part II; L.D. Myers & A. Stallard; Kansas State Highway Commission & FHWA; 1974.

Document provided to S.S.I.E. by the H.R.I.S.

Addenda: This project is also supported by: Kansas State Highway Commission.

SUPPORTED BY U.S. Dept. of Transportation - F.H.A.

5.0016, MONITORING FLOW PATTERNS AND SEDIMENT AND POLLUTANT DISPERSION WITH 24-CHANNEL SCANNER DATA

J.L. DECELL, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0F8186)

The objective of this study is to develop procedures for monitoring flow patterns and sediment and pollutant dispersion in water bodies from digital tape data obtained with an aircraft-mounted Bendix 24-channel Multispectral Scanner. Specific objectives will be to define concentrations of suspended material in selected rivers in the Chesapeake Bay area and compare the results with the results of a previous study using satellite data, to determine minimum water surface area that can be detected, and to determine whether water movement induced by tidal action or storms can be detected and monitored.

Existing 24-channel multispectral data obtained by NASA from the Chesapeake Bay area in support of the ERTS (LANDSAT) program will be used. Computer formatting, interpretation, display techniques, and analytical procedures will be developed to process the digital tape data to accomplish the desired objectives. The product of this study will be digitally derived maps and film transparencies keyed to maps of various scales and a letter report briefly explaining the developed procedures for their production.

Supporting agency address information: OCE Waterways Experiment Station, P.O. Box 631, Vicksburg, Ms. 39180

SUPPORTED BY U.S. Dept. of Defense - Army

5.0017, AERONOMY OF THE STRATOSPHERE AND MESOSPHERE 12589-GS

L. HALE, Penn. State University, School of Engineering, *University Park, Pennsylvania* 16802 (DA0E8998; DAHC04-75-G-0031)

To better understand the composition of the upper stratosphere and mesosphere and the coupling of this composition with the electrical structure of this region and with lower level meteorological parameters. The determination of the composition of the nuclearly undisturbed atmosphere is basic to the prediction of atmospheric effects upon communications, surveillance, and ballistic missile defense systems. The work directly supports research programs at the Atmospheric Sciences Laboratory and the Ballistic Research Laboratories.

The research involves instrumentation, observation, and analysis phases. Measurements of the oxides of nitrogen and the electrical structure of the upper stratosphere and mesosphere will be made using parachute and balloon borne probes.

Supporting agency address information: AMC Army Rsch Office, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

5.0018, A SYNOPTIC STUDY OF THE VARIABILITY OF MESOSPHERIC IONIZATION IN WINTER 10287-EN

L.C. HALE, Penn. State University, School of Engineering, *University Park, Pennsylvania* 16802 (DA0D8971; DA-ARO(D)-31-124-72-G158)

To study the variability of mesospheric ionization in winter, in an attempt to aid in the characterization of physical processes involved in the altitude range of 60-70 km where the transition from solar ultraviolet to galactic cosmic ray ionizations take place. The anticipated results have an important application to radio-wave propagation in the presence of either natural or man-induced ionospheric distrubances. They are also directly relevant to mesospheric sounding, communications and missile reentry phenomena.

A parachute-borne blunt probe technique will be used to provide information about the variability of positive ions and electrons.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

5.0019, STUDY OF ATMOSPHERIC AND ELECTRICAL CONDUCTIVITY AS RELATED TO AIR QUALITY

S.E. JENNINGS, Univ. of Durham, *Durham, England, United Kingdom* (DA0C9380; DAJA37-75-C-1913)

To study some of the physical characteristics of natural atmospheric aerosols, utilizing samples from Durham Observatory and the northern Pennines.

Undertake both field sampling and laboratory analysis techniques. A number of aerosol characteristics will be studied over a wide range of meteorological parameters so as to establish factors which control or modify aerosol parameters. Study relevant to: communications; employment of lasers; study of air pollutions; small area forecasting; and Army aviation.

Supporting agency address information: AMC European Research Offices (Europe), Box 15, US Forces FPO NY 09510

SUPPORTED BY U.S. Dept. of Defense - Army

5.0020, ANALYSIS OF STRATOSPHERIC DATA

J. HUGHES, U.S. Navy, Office of Naval Research, *Arlington, Virginia* 22217 (055981 (TRAIS NO.))

The University of Melbourne, Melbourne, Australia will conduct up to six scientific balloon flights to acquire additional stratospheric aerosol, ozone, water, temperature, pressure and wind data in order to more precisely characterize the upper atmosphere of the southern atmosphere. Data is to be analyzed and correlated as part of the global monitoring program of the University of Wyoming. Task 2 The Commonwealth Scientific and Industrial Research Organization (CSIRO) Sydney, Australia will complete an analysis of existing special dust collections from stratosphere of Southern Hemisphere including, in addition to particulate sizes and number density, identification of acidic constituents and salts. Integrate data with dust sonde data of University of Wyoming.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - Off. Sec.

5.0021, WATER RESOURCES DIVISION SATELLITE DATA RELAY PROJECT

R.W. PAULSON, U.S. Dept. of the Interior, Geological Survey, *Herndon, Virginia* 22092 (WD 61-111)

There is a rapidly developing satellite data collection system technology that may provide the water resources division with new and economical means for collecting remote site water-resources data. Recent tests of the earth resources technology satellite data collection system have demonstrated the feasibility of mating usgs field instruments with field radios, and routinely relaying the data. The geostationary operational environmental satellite data collection system holds promise as an operational tool, but is yet untested with WRD instruments and applications.

The objectives are to test, and evaluate the performance characteristics of the ERTS, GOES and subsequently available satellite data collection systems as potentional operational WRD tools.

A number of ERTS-DCS experiments have been conducted, and will continue. The GOES-DCS will be tested in FY75. This project will have overall responsibility for the program of testing these systems. The program will consist of technical coordination and direction from the project leader in Reston, computer software support being developed in the district office in Harrisburg and in the ADP section in Reston and a subordinate project, headquartered in the Gulf Coast Hydroscience Center, which will provide general software support and will test receive-site technology. This support project is entitled 'Water Resources Division Satellite Data Relay Equipment Support Project.'

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0022, A STUDY OF THE SPATIAL AND TEMPORAL VARIATION OF TEMPERATURE IN THE ATMOSPHERIC BOUNDARY LAYER 11586-EN

J.A. BUSINGER, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DA0D9198; DAHC04-74-G-0022)

To extend the knowledge of boundary layer turbulent transport processes through a study involving both experimental and theoretical investigations. Better understanding of the structure of turbulence in the layer of air near the ground is important in the prediction of transport, diffusion and concentration of gases and aerosols, and in the improvement of optical systems. Such systems have diverse military applications ranging from detection and tracking to remote sensing of properties of the earth and atmosphere.

The field research involves use of a computer-controlled real time data collection and analysis system for measurement of the time and spatial variation of temperature fluctuations, atmospheric stability, heat and momentum fluxes of surfaces of roughness. The theoretical research involves analyses of the temperature data to verify and improve techniques for indirectly obtaining stability, heat and momentum fluxes exclusively from the temperature statistics and gross meteorological parameters over as wide a stability range as possible.

Supporting agency address information: AMC Army Rsch Office Research, Triangle Park, N. C. 27709

SUPPORTED BY U.S. Dept. of Defense - Army

5.0023, POLAR ICE REMOTE SENSING
W.J. CAMPBELL, U.S. Dept. of the Interior, Geological Survey, *Tacoma, Washington* 98402 (WR 00-064)

The fastest varying large-scale feature on the earth's surface is sea ice. Theoretical studies show the ice canopy in polar regions to be of major importance in 1) determining the global heat balance, and 2) determining the vapor flux of water into temperate regions. In order to test the developing numerical models of polar regions it is necessary to acquire sequential, large-scale, synoptic data over polar regions. Remote sensing, especially in frequencies in the microwave range, appears to offer the best chance of obtaining these data.

As the Principal Investigator for sea ice for Nasa-Spacecraft Oceanography Center, we will design a polar remote sensing experiment utilizing NASA, Navy and Coast Guard aircraft which will coincide with the 1972 Arctic Ice Dynamics Joint Experiment (AIDJEX) expedition, which will be used as the ground truth network for the remote sensing systems. The basic premise for these plans will be to develop the correct remote sensing means to acquire data that will be useful in testing numerical models of the sea ice.

Overflights during FY 70 and 71 using NASA aircraft in polar missions under our direction have shown that the two frequencies that appear to be the greatest potential use in observing sea ice are passive microwave and synthetic aperature radar (SLAR). Therefore in the 1972 field experiments over the Arctic Ocean the acquisition of microwave and SLAR imagery will be stressed and an intense ground truth program will be carried out. We have also been quite influential in stressing the need for microwave imaging systems on polar orbit satellites. The prime reason that a 37 GHz imager will be installed on Nimbus F is because of our input into the NASA satellite program.

The data from the joint USSR/US Bering Sea experiment (BESEX) has been reduced and the results written up in a series of papers given at the Bering Sea Symposium in Leningrad in May 1974, along with the results of the Soviet effort. The experiment proved to be a highly successful one, and sequential data gathered on the morphology and dynamics of first-year and younger sea ice is the best obtained yet. The AIDJEX main experiment is scheduled to begin in the spring of 1975. This project office has had the task of planning and coordinating the remote sensing part of the experiment. (Text Abridged)

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, TECHNICAL AND ADMINISTRATIVE SUPPORT TO ARMY AEROMEDICAL RESEARCH (01)
R.W. BAILEY, U.S. Army, Aeromedical Research Lab., *Ozark, Alabama* 36360 (DA0D6737)

To provide technical, logistical and administrative support to those involved in army aeromedical research at the US Army Aeromedical Research Laboratory.

To evaluate and then supply, insofar as possible, the technical, logistical and administrative support required by research members of the laboratory in order that the laboratory can fulfill its mission. Among other things, this includes provision for scientific guidance and advice, technical support in development, construction, distribution and maintenance of research equipment and associated items, the attainment, distribution and cataloging of scientific literature, accounting, bookkeeping and clerical support. It also provides that these areas will be administered under an administration utilizing sound and accepted managerial practices.

Supporting agency address information: MD R&D Com, (Army) Aeromedical Res Lab, Ft. Rucker, Al. 36360

SUPPORTED BY U.S. Dept. of Defense - Army

6.0002, RESEARCH OF PSYCHOACOUSTICAL PROBLEMS MEDICALLY SIGNIFICANT TO ARMY AVIATION (05)
R.T. CAMP, U.S. Army, Aeromedical Research Lab., *Ozark, Alabama* 36360 (DA0D6739)

To provide information about sound which has medical import to U. S. Army aviation.

The approach will be twofold. One will entail the physical description of the critical sound stimuli found in U. S. Army aviation. This will involve descriptions at the generators or sources as well as descriptions of subsequent changes that may be precipitated by various propagating media. The second approach will involve studying the effects of these sounds on human receivers. Both approaches will employ valid research practices.

Supporting agency address information: MD R&D Com, (Army) Aeromedical Res Lab, Ft. Rucker, Al. 36360

SUPPORTED BY U.S. Dept. of Defense - Army

6.0003, RESEARCH OF VISUAL PROBLEMS MEDICALLY SIGNIFICANT TO ARMY AVIATION (04)
J.K. CROSLEY, U.S. Army, Aeromedical Research Lab., *Ozark, Alabama* 36360 (DA0D6733)

To provide information about the visual sensory modality which has medical importance for U. S. Army aviation.

The approach will involve the employment of sound visual research practices in studying vision in its current and potential use in Army aviation.

Supporting agency address information: MD R&D Com, (Army) Aeromedical Res Lab, Ft. Rucker, Al. 36360

SUPPORTED BY U.S. Dept. of Defense - Army

6.0004, RESEARCH PSYCHOLOGY APPLIED TO MEDICALLY SIGNIFICANT PROBLEMS IN ARMY AVIATION
M.A. HOFMANN, U.S. Army, Aviation Psychology Division, *Ozark, Alabama* 36360 (DA0D6738)

To provide US Army aviation information that is medically important about the human factor in the aircraft man-machine system, with special emphasis on the performance of this human factor and the variables that influence it.

The approach will involve the application of current research techniques applicable to the objective as well as developing new techniques as required.

Supporting agency address information: MD R&D Com, (Army) Aeromedical Res Lab, Ft. Rucker, Al. 36360

SUPPORTED BY U.S. Dept. of Defense - Army

6.0005, DIRECT FIELD RESEARCH SUPPORT TO IMMEDIATE ARMY AEROMEDICAL PROBLEMS (02)
S.C. KNAPP, U.S. Army, Aeromedical Research Lab., *Ozark, Alabama* 36360 (DA0D6734)

Provide US Army aviation with sound and timely bioengineering information to solve operational problems generated in the interface of the physical and life sciences.

The techniques employed will vary, depending on the problem area, but will be based on sound, accepted experimental methodology designed to provide the required information as expeditiously as possible.

Supporting agency address information: Md R&D Com, (Army) Aeromedical Res Lab, Ft. Rucker, Al. 36360

SUPPORTED BY U.S. Dept. of Defense - Army

6.0006, RESEARCH OF BIOENGINEERING PROBLEMS MEDICALLY SIGNIFICANT TO ARMY AVIATION (01)
S.C. KNAPP, U.S. Army, Aeromedical Research Lab., *Ozark, Alabama* 36360 (DA0D6735)

To provide valid, meaningful and medically pertinent information, new designs and equipment developments based on research with respect to immediate field aeromedical problem areas found in US Army aviation.

Approach will always be based on sound and accepted experimental methodology, though particular techniques of application will vary as a function of the problem under investigation.

Supporting agency address information: MD R&D Com, (Army) Aeromedical Res Lab, Ft. Rucker, Al. 36360

SUPPORTED BY U.S. Dept. of Defense - Army

6.0007, RESEARCH OF BIOENGINEERING AND VIBRATION PROBLEMS MEDICALLY SIGNIFICANT TO ARMY AVIATION
S.C. KNAPP, U.S. Army, Bioengineering & Eval. Div., *Ozark, Alabama* 36360 (DA0E6733)

To determine the short-term clinical effect of helicopter vibration on the musculoskeletal system and to develop an orthopaedically, anthropometrically sound helicopter crew seat to reduce vibration effects.

Prospective clinical and epidemiologic study using physical examination subjective reporting forms, Norland bone mineral analysis, biochemistry, and X-ray techniques. Seat design and validation will be accomplished statically and dynamically on a three degree of freedom, man-rated vibration table using dynamic EMG techniques. Pilot performance and efficiency are studied.

Supporting agency address information: MDRDC Aeromedical Research Lab, Ft. Rucker, Al. 36360

SUPPORTED BY U.S. Dept. of Defense - Army

6.0008, MEDICAL RESEARCH APPLIED TO THE PROBLEMS IN ARMY AVIATION (03)
W.P. SCHANE, U.S. Army, Aviation Medicine Res. Div., *Ozark, Alabama* 36360 (DA0D6736)

To provide the US Army information about those variables found in Army aviation which influence the health of the aviator.

To apply accepted medical research methods in Army aviation to fulfill the above objective.

Supporting agency address information: MD R&D Com, (Army) Aeromedical Res Lab, Ft. Rucker, Al. 36360

SUPPORTED BY U.S. Dept. of Defense - Army

6.0009, VISUAL DISPLAY BRIGHTNESS AND MOTION INTERACTION
J.E. BROWN, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF222070)

To investigate the effects of visual display brightness and simulator motion as a function of task variables in ASUPT.

A two-phase study is proposed in which the first phase will use experienced pilots as subjects and the second phase will use UPT candidates. A 3x2x2x4 Anova design will be used. Three levels of environmental brightness will be examined which will be selected to correspond to existing off-the-shelf visual systems. These three levels will be: level I (daytime), level II (twilight), and level III (night). Four levels of difficulty for flying tasks will be developed. These will range from simple instrument type tasks (ILS with breakout to contact) up to and including contact tasks having a high difficulty level (air- to-ground, formation, etc.). Specific tasks will be selected to be representative of those maneuvers found in UPT. Four conditions of motion (motion on/motion off in combination with g-seat on and g-seat off) will be investigated to assess their effect upon pilot performance.

Supporting agency address information: AF Human Resources Laboratory FTS, Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0010, HUMAN FACTORS ENGINEERING IN SUPPORT OF AVIATION, ARMOR, COMMUNICATIONS, ENGINEER AND MISSILE EQUIPMENT
J.R. ERICKSON, U.S. Army, Human Engineering Labs., *Aberdeen Proving Ground, Maryland* 21005 (DA0A4942)

To perform human factors engineering analysis and experimental studies in support of missiles, communications, aviation, and engineer equipment. To develop analytic methods and procedures for assessing human factors engineering requirements and criteria in the development of large complex systems and procurement of off-the-shelf items of engineering equipment. Research in the area of human factors in maintainability, aviation equipment, complex displays and information processing for field operations will be conducted.

Studies will be conducted to: develop human engineering criteria for air defense and command control displays and information processing equipment; determine human factors implications of performing communication tasks on-the-move; investigate switchboard operator call handling variables.

Supporting agency address information: AMC Human Engineering Labs, Aberdeen PG, Md. 21005

SUPPORTED BY U.S. Dept. of Defense - Army

6.0011, KEEPING TRACK OF SEQUENTIAL INFORMATION IN MILITARY OPERATIONS
R.A. MONTY, U.S. Army, Human Engineering Labs., *Aberdeen Proving Ground, Maryland* 21005 (DA0A4957)

In many military operations such as in command or air traffic control centers, great quantities of information are displayed to the operators in a continuous, sequential fashion. The operator at any given moment may be called upon to assimilate past information with current information and make decisions accordingly. This program is designed to isolate those factors which determine the operator's capacity to perform such tasks and to devise principles for the optimal display of information, both visual and auditory.

Carry out basic experiments to: (1) examine the coding strategies normally adopted by subjects in keeping track of situations and attempt to modify or improve those strategies to enhance performance; (2) examine the effects of irrelevant information on performance; (3) examine the extent to which information transmission rate can be enhanced by exposing multiple stimuli simultaneously. Work will also examine studies of related perceptual processes. Results of this research have direct application to many Army equipment operator jobs.

Supporting agency address information: AMC Human Engineering Labs, Aberdeen PG, Md. 21005

SUPPORTED BY U.S. Dept. of Defense - Army

6.0012, STUDY OF PERFORMANCE OF INSTRUMENTED MANIKINS IN MEASURING THERMAL PROTECTION
E.T. WALDRON, U.S. Army, Natick Development Center, *Natick, Massachusetts* 01760 (DA0F4280)

Determine sensitivity levels and data acquisition adequacy of instrumented manikins (both Air Force- and Army-developed) used to measure the thermal protection provided by aviators' and tankers' uniforms.

Utilize manikins instrumented with 'true' skin simulants and predict protection through standard techniques, such as equating burns with a damage integral of 1.0.

Supporting agency address information: AMC Natick Development Center, Natick, Ma. 01760

SUPPORTED BY U.S. Dept. of Defense - Army

6.0013, CALCIUM TURNOVER IN OTOLITHIC MEMBRANES
L. JOHNSSON, Univ. of Michigan, School of Medicine, *Ann Arbor, Michigan* 48104 (NS 11672-02)

Virtually nothing is known about the metabolism of otoconia. Findings in our study of human temporal bones and drug-treated animals suggest that otoconia are continuously being formed and are subject to attrition and disturbances of morphogenesis. Our present results using Ca45 tracer support this concept. This study concerns the rate of turnover of calcium in the otoconia, and investigations of possible disturbances of the uptake. Radioactive calcium, Ca45 will be given in repeated doses to gerbils which are used because their small size permits a high dose of Ca45 in relation to body weight. After the animals have been sacrificed at different time intervals the entire otolithic membranes are removed by means of microdissection. Samples are weighed and counted by liquid scintillation spectrometry. This method is very sensitive and represents the best quantitative method presently available. The uptake of calcium will be measured in relation to time and total dry weight of the otoconia. Since our preliminary results indicate uptake of Ca45 in the so-called 'dark cells' in the wall of the utricle, the incorporation of Ca45 in these cells will be investigated. Autoradiography will be carried out in an attempt to localize areas of activity. The effect of vestibulo-toxic drugs on the possible turnover of calcium will be studied by administering streptomycin and gentamicin in appropriate doses. In a final phase we plan to study the calcium uptake in animals with negative calcium balance (hyperparathroidism, rickets, possibly immobilization and senility)in order to find out how the otoconia relate to the body calcium pool. Normal otoconia and abnormal otoconia found in temporal bones from patients with congenital and hereditary hearing loss are being analyzed by powder X-ray diffraction and electron microprobe analyzer. The presence of trace elements in these otoconia will be determined and an attempt will be made to demonstrate differences in composition between central and peripheral regions within the otoconium. The study has basic importance for the clinical otologist. Since man now is exposed to extended periods of weightlessness and to the resulting disturbance of calcium metabolism, it should help to illuminate some of the problems of space medicine.

SUPPORTED BY U.S. Dept. of Hlth. Ed. & Wel. - N.I.H.

6.0014, AIRCREW PERFORMANCE ENHANCEMENT (TECHNOLOGICAL BASE)
D. MESITER, U.S. Army, Org. & Systems Research Lab., *Arlington, Virginia* 22209 (DA0B9913)

(1) To develop basic data, principles and techniques for specifying how aviator tasks should be performed in existing and future Army systems; (2) to develop methods for measuring and evaluating the performance of Army aviators; (3) to develop and test alternative work methods for performing operational flight missions more efficiently; and (4) to derive procedures, work methods and devices capable of increasing the effectiveness of army aviation selection and training.

(1) Identify critical factors in flight, by task analysis of operational flight missions; (2) to determine factors inducing stress and reduced performance in aircrews; (3) to conduct experimentation to determine combinations of parameters producing more effective flight performance.

Supporting agency address information: OCRD Organizations & Systems Research Lab, 1300 Wilson Blvd, Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Army

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, DEVELOPMENT OF MODELS FOR THE INFRARED RADIATION FROM EXHAUST PLUMES
K. HARWELL, Auburn University, School of Engineering, *Auburn, Alabama* 36830 (DA0E1412; DAAH01-75-C-0121)

This work is designed to develop numerical computer models for describing both the gas dynamics and infrared radiation emitted from subsonic and supersonic turbojet and rocket exhaust plumes. Efforts will also include characterization of imbedded shock waves, Mach discs and the turbulent mixing layer.

The appropriate physical, thermodynamic and chemical equations describing the gas dynamics will be solved with suitable approximations, where necessary, to achieve a tractable numerical solution on a high- speed digital computer. These results will be combined with existing and upgraded versions of gaseous radiation models to yield plume emission characteristics. Results will be compared to experimental data generated by subscale and full-scale plume generators.

Supporting agency address information: MICOM Advanced Sensors Directorate, MRD&EL, Redstone Arsenal, Al. 35809

SUPPORTED BY U.S. Dept. of Defense - Army

7.0002, RESEARCH IN CALCULUS OF VARIATIONS, NUMERICAL ANALYSIS AND RELATED FIELDS 5863-M
M. HESTENES, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (DA0A8911; DA-ARO(D)-31-124-71-G18)

To increase the knowledge of numerical analysis and calculus of variations. This work is a study of methods of optimal control (methods of controlling a system to make a desired benefit as large as possible or a penalty as small as possible). These methods will be applicable to logistical problems (control of inventory at a storage depot) and physical problems (control of flight path and rate of fuel consumption of an airplane or helicopter to obtain maximum range).

Approach - the theory of quadratic forms in Hilbert space will be the starting point. Studies will include 1) matrix theory of differential equations from the point of view of computation, 2) optimal control problems from both the theoretical and computational points of view, 3) connections with dynamic programming, and 4) multiple integrals and the associated theory of partial differential equations.

Supporting agency address information: AMC Research Office Durham, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

7.0003, QUALITATIVE PROPERTIES OF DIFFERENTIAL EQUATIONS 11655-M
H.A. ANTOSIEWICZ, Univ. of Southern California, School of Letters Arts & Sci., *Los Angeles, California* 90007 (DA0D9194; DAHC04-74-G-0013)

To conduct a qualitative study of differential equations and generalized boundary value problems. Results of this research will be applicable to the design of control systems for use in missiles, automatic weapons, fire control and aircraft. Singular perturbation problems occur in various flow problems. This study will also enhance the understanding of problems relating to flow over projectiles, missiles, and other similar configurations.

Studies will include: (1) existence theorems for differential relations and functional-analytic methods for generalized boundary value problems for nonlinear ordinary differential equations; (2) singular perturbation problems and the analytic theory of differential and difference equations; and (3) skew-product flows in topological dynamics and their applications to ordinary differential equations.

Supporting agency address information: AMC Army Research Office, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

7.0004, DIGITAL TECHNIQUES FOR MULTIPLE SIGNAL ENVIRONMENTS
S.W. GOLOMB, Univ. of Southern California, School of Letters Arts & Sci., *Los Angeles, California* 90007 (DA0B9254; DA-ARO(D)-31-124-72-G42)

To increase the understanding of shift register sequences and their applications to communication systems.

Approach - an investigation will be made of digital signalling techniques for minimizing cross-channel interference when there are a large number of communicators using portions of a common band of frequencies. Signal sets with the following properties will be investigated: (1) maximum interference between pairs of signals is minimal, (2) each signal is easily generated, (3) a practical solution to the signal detection problem can be given. Certain functions defined on Galois fields can be readily generated by shift registers or by Boolean functions using shift register states as inputs. This investigation will focus attention on such functions using algebraic methods of analysis.

Supporting agency address information: AMC Research Office Durham, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

7.0005, DESIGN OF PRACTICAL CONTROL ALGORITHMS FOR NONLINEAR STOCHASTIC SYSTEMS
D.L. ALSPACH, Applied Systems Corporation, *San Diego, California* (DF040520; F44620-75-C-0023)

In the control of complex Air Force aerospace systems such as aircraft, missiles, navigation systems and jet engines there is a growing need for more flexibility in selecting methods for control analysis and system synthesis. This is particularly true for stochastic systems in which nonlinearities play a significant role. The central core of the problem lies in the measured data, the noise-corrupted signals which convey information about the system state. After processing, this information is used in controlling the system. When both the estimation and control problems are linear they may be accomplished separately without loss of system optimality in a quadratic sense. When the problem is nonlinear this is no longer the case. The estimation may still be completed optimally. However, the controller in this case has two objectives. The first is the obvious function of controlling the system so as to minimize some cost functional. The second controller objective is to drive the system so as to improve the estimation function through control probing. Because of the double role of the controller this concept is called dual control. Unfortunately it suffers from the curse of dimensionality and is not implementable. This proposal is for research on an alternative solution. Research effort in nonlinear filtering in recent years has generated some greatly improved nonlinear estimation techniques. This research will be an investigation of the advantages to be gained by employing these techniques in conjunction with optimal or nearly optimal deterministic controls. Using these results and some knowledge of the shape of the posteriori noise densities, the effect of intelligent but non-optimal probing signals will be investigated.

Supporting agency address information: AF Office of Scientific Research NM, 1400 Wilson Blvd, Arlington, Va. 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0006, COMPUTER-AIDED MATHEMATICS 11432-RT
N. BURGOYNE, Univ. of California, Graduate School, *Santa Cruz, California* 95060 (DA0D9131; DAHC04-74-G-0196)

To develop computational routines to aid in mathematical research. Relevance - the present in-house symbolic manipulation capability remains at the level of Formac, and a further sophistication is desired. Development of computational aid for mathematicians will have benefits for Army application. This especially is true in terms of the Army's Computer-Aided Design and Engineering (CAD-E) program, where the results of mathematical research in more flexible and easily usable forms are needed for the subsequent application to weapon design and engineering. The proposal seems relevant, for instance, to the areas of CAD-E works related to flight stability, control, and optical design.

Certain explicit problems of current interest in two distinct areas of mathematics, finite group theory and nonlinear ordinary differential equations, will be pursued. It is intended to develop a large number of related routines for doing nontrivial algebraic calculations involving matrices and polynomials and to find master routines which will control the various systems of routines.

Supporting agency address information: AMC Army Rsch Office, (ARO- D). Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

7.0007, NEW ALGEBRAIC METHODS IN THE ANALYSIS AND SYNTHESIS OF COMPLEX SYSTEMS 11554-RT
E.W. KAMEN, Georgia Inst. of Technology, School of Electrical Engin., *Atlanta, Georgia* 30332 (DA0D9124; DA-ARO(D)-31-124-73-G171)

This research will address the problem of extension of mathematical analysis of control systems to include time-varying systems such as adaptive control systems, biological systems with time delays, and time- varying communication systems. Relevance - this research has the objective of extending and simplifying mathematical techniques for the analysis of systems such as integrated circuits with lumped-distributed component, adaptive control systems, and communications systems with time-varying channels such as radio links, which are of interest to the Army.

The approach will be to express the input-output behavior of a multiterminal linear system in terms of an operational transfer function in the form of a matrix composed of polynomial operators. The resulting representation provides an algebraic framework which is computationally convenient since polynomial operator equations can be solved on a computer.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

7.0008, NUMERICAL SOLUTION OF THREE-DIMENSIONAL LAMINAR BOUNDARY LAYER EQUATIONS 10839-E
K.C. WANG, Martin Marietta Corporation, *Baltimore, Maryland* 21227 (DA0D9088; DAHC04-73-C-0011)

To provide a numerical solution of the three-dimensional incompressible laminar boundary layers with particular interest in those over bodies of revolution at arbitrary incidence. This study is related to flows over projectiles and missiles. The spinning case will be helpful in understanding the Magnus effect. Any knowledge obtained from this study is directly applicable to the design of missiles, ordnance, aircraft and helicopters.

Phase I will concentrate on the boundary layer calculation over an ellipsoid of revolution, i.e., a prolate spheroid at low (6 deg) and high (30 deg) incidences. Phase II will extend the calculations to include spinning effects and possibly compressibility and heat transfer.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

7.0009, INVESTIGATION IN NONLINEAR MECHANICS 11600-M
W.S. LOUD, Univ. of Minnesota, School of Mathematics, *Minneapolis, Minnesota* 55455 (DA0D9150; DA-ARO(D)-31-124-73-G199)

To investigate the stability and branching of nonlinear equations. the class of differential equations considered occur in the analyses of dynamical and vibrational systems. The proposed investigation is particularly relevent in the study of nonlinear control problems associated with weapon systems and in the study of stability of large deformations of structures like those incountered in aircraft.

Areas of research will include: (1) study of stability regions of ordinary differential equations; (2) further study of implicit function theorem with reference to branching of solutions of differential equations; (3) application of branching theory to boundary value problems other than periodic solutions; (4) study of generalized inverses of differential operators.

Supporting agency address information: AMC Army Rsch Office, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

7.0010, HIGH-SPEED ROTOR BALANCING 12515-E
W.D. PILKEY, Univ. of Virginia, School of Engin. & Appl. Sci., *Charlottesville, Virginia* 22903 (DA0B5576; DAHC04-75-G-0055)

To develop (1) mathematical programming techniques to optimize the balancing of rotors, and (2) optimize design of suspension systems for rotating shafts. Relevance - the Army is using heavy equipment, large shafts, and high-speed rotating systems. These require new and sensitive methods of balancing as well as improved methods of suspension. This proposal is addressed to just such needs.

The approach is mathematical, using programming techniques as well as statistical methods to investigate noise in the system and its relation to system sensitivity.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, THEORETICAL INVESTIGATION OF MAGNETIC AND INSULATOR-METAL TRANSITIONS 8315-P
D.M. ESTERLING, Indiana University, School of Arts & Sciences, *Bloomington*, *Indiana* 47401 (DA0C9175; DA-ARO(D)-31-124-73-G180)

To develop a fundamental understanding of magnetic phase transitions and metal-non-metal transitions. The Army makes increasing use of devices based on the magnetic, conducting and insulating properties of materials in its communications, surveillance, data processing and other field equipment. It is the goal of the present work to provide a theoretical basis for a clearer and more complete understanding of the underlying mechanisms of magnetic and insulating vs conducting states of solids.

Research will be concerned with: (1) the application of the Hubbard model to magnetic and superconducting transition metals and organic salts that show promise of high T sub C (66k) superconductivity; (2) the study of disordered nonmagnetic and magnetic alloys; (3) the calculation of high order elastic constants in hop lattices; (4) the study of metal-insulator transition; (5) the examination of resistance anomalies in B.C.C. Ti-transition metal alloys.

Supporting agency address information: AMC Army Rsch Office (ARO-D, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

8.0002, NOISE ABATEMENT & INTERNAL VIBRATION ABSORPTION IN POTENTIAL STRUCTURAL MATERIALS
S.A. KULIN, Manlabs Incorporated, *Cambridge*, *Massachusetts* 02138 (DA0E4778; DAAG46-74-C-0048)

To explore the physical basis on which structural materials with high damping capacity can effectively convert acoustic energy (10 hertz- 10,000 hertz) to heat.

To establish the mechanism of acoustical damping in selected materials, which preliminary evidence has indicated as prime candidates materials through a) structural studies by X-ray diffraction and electron microscopy, b) thermodynamic studies by differential thermal analysis, and c) physical parameter studies by vibrational damping as well as yield and strength measurements. The systems to be studied include TINi, Cu3Al, and those Fe, Co, Ni alloys near two-phase regions.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, Attn-AMXMR-D, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

8.0003, WAVE PROPAGATION AND THE BEHAVIOR OF THE ATMOSPHERE AND IONOSPHERE 12286-GS
W.L. DONN, Columbia University, School of Arts & Sciences, *New York*, *New York* 10027 (DA0E8905; DAHC04-74-G-0172)

To study long-range propagation of acoustic waves in the atmosphere including the ionosphere. The information obtained will help in the prediction of the effects of ionospheric tilting and multiphath conditions of HF radio-wave propagation and will be applied to reduce bearing errors in a single-site radio emitter locator system currently under Army development. The research is also relevenat to an Army program to study acoustic waves from satellites and from the ground to determine their contribution to the occurrence of severe storms and their role in interactions between the lower and upper atmosphere relevant to ABMDA concerns.

The work involves the observation of long waves with a number of sensing systems capable of detecting gravity and acoustic waves in the atmosphere. Trace velocities, directions and spectral content of the signals are determined through the use of on-line and off-line computers. Theoretical studies involve utilizing the observations in determining atmospheric conditions which contribute to the nature of the wave propagation. A continuous wave ionospheric height detection system will be developed and used to obtain wave group path information in the ionosphere through continuous monitoring of the height of reflection of high-frequency radio waves.

Supporting agency address information: AMC Research Office Durham, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

8.0004, ATOMIC BEAM SCATTERING STUDIES 10665-P
B. BEDERSON, New York University, School of Arts & Sciences, *New York*, *New York* 10012 (DA0D9043; DA-ARO(D)-31-124-73-G20)

To contribute to reliable measurements of electron-atom and electron-molecule scattering cross-sections in order to provide basic information about scattering processes. Data which will be produced during the course of this research will permit calculations on upper atmospheric phenomena directly related to long-range military communications and ballistic missile defense in a nuclear environment.

Experimental work will include: (1) measurement of atomic and molecular polarizabilities, (2) performance of electron-atom collision experiments with spin analysis, and (3) perfecting a 'universal' technique for measuring total electron atom and electron-molecule collision cross-sections using atomic beam recoils.

Supporting agency address information: AMC Army Rsch Office (ARO- D), Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

8.0005, RADIATIVE PROPERTIES OF SIMPLE MOLECULES AND METAL ATOM CHEMIEXCITATION P.A.S.I.
M.A. BIONDI, Univ. of Pittsburgh, School of Arts & Sciences, *Pittsburgh*, *Pennsylvania* 15260 (DA0C8984; DA-31-124-ARO(D)-440)

To measure the radiative and collisional lifetimes of radiating states of simple molecules such as No sub 2 and So sub 2 which are important to our understanding of nuclear effects on air chemistry. Measurement of the fundamental radiative and collisional parameters permits accurate prediction of optical phenomena over a wide range of ambient conditions. This part of the task has been phased out. Energy partitioning among products of exothermic reactions involving alkali atoms. Sodium excitation and line broadening studies. Evaluation of chemi-excitation processes for new lasers.

A fluorescence apparatus with modulated or flash irradiation and variable monochromatic excitation and fluorescence detection is used for the lifetime studies. Phase shift experiments at variable pressures determine radiative and collisional lifetimes. A chemiluminescence line shape apparatus (Fabry-Perot interferometer) is used in na chemi- excitation experiments.

Supporting agency address information: AMC Army Research Office ARO-D, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

8.0006, INFRARED EMISSION RESULTING FROM FUEL-OXIDIZER REACTIONS 6563-P
M.A. BIONDI, Univ. of Pittsburgh, School of Arts & Sciences, *Pittsburgh*, *Pennsylvania* 15260 (DA0E5576; DA-31-124-ARO(D)-440)

The emission of infrared radiation arising from a variety of fuel- oxidizer systems, at pressures between 0.1 and 20 torr (equivalent altitudes of 25 to 50 km) is measured in a versatile discharge-flow system at wavelengths from 1.1 to 6.5 mu m in order to examine both thermal and chemiluminescent emission due to various stable product and reactive intermediate species.

The radiation is produced in a small mixing region in rapid flow, dispersed with cooled circular variable filters of 0.02 to 0.10 mu m bandpass, and detected with good space resolution-limited INSB detectors and matched, cooled preamplifiers. Absolute emission intensities are measured and the decay of the emission due to radiation or quenching is also determined along the flow tube.

Supporting agency address information: AMC Army Research Office, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

8.0007, ATMOSPHERIC TURBULENCE EFFECTS ON THE TEMPORAL-SPECTRAL DENSITIES OF OPTICAL SIGNALS

J. SMITH, Univ. of Texas, School of Engineering, *El Paso, Texas* 79999 (DA0H5579; DAHC04-75-G-0102)

To develop models for optical crosswind systems to describe the temporal spectral densities of remote scenes viewed through a turbulent atmosphere. Relevance - atmospheric turbulence effects over different ranges is important in several laser propagation systems being developed or currently used in the Army. ASL is particularly interested in turbulence effects in the laser remote sensing crosswind measurement system under development for use in the main battle tank. 'The program could be relevant and important for laser weapon systems or systems employing laser guidance' (MICOM). 'The resolution of the effects of saturation is fundamental to the application of this scheme (optical measurement of wind) under many turbulence-path-length conditions' (BRL).

Simultaneous measurements yielding the spectral densities obtained from intensity and angle of arrival fluctuations of remote scenes and of beams from coherent sources will be made over 0.5 km and 2.0 km horizontal paths during periods of strong and weak turbulence and a variety of wind conditions. The spectral characteristics will be compared with in situ measurements of related meteorological parameters to check the validity of the model predictions. Upon establishment of the expected spectral characteristics, spatial and temporal filters will be used to obtain wind profiles along the path.

Supporting agency address information: AMC Army Research Office, Box 12211, Research Triangle Pk, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

GENERAL

11.0001, STUDY THE FEASIBILITY OF DEVELOPING DEHYDRATED NATURAL FRUIT JUICES FOR USE ABOARD USAF AIRCRAFT OPERATING ABOVE 50,000 FEET (AF 3-15)

A.R. RAHMAN, U.S. Army, Natick Development Center, *Natick, Massachusetts* 01760 (DA0F4338)

Develop technology for producing dehydrated natural fruit juices which will retain quality and desirable rehydration characteristics for six months while stored at 21 degrees C in flexible packages evacuated to a total pressure differential of one atmosphere. These beverages are required to support aeronautical missions in USAF aircraft which operate at 50,000 feet, where weight and volume constraints are rigid and refrigerated storage is non-existent.

Study the dehydration and rehydration behavior of selected fruit juices such as orange, grapefruit and pineapple in relation to the effect of storage at elevated temperature on their overall quality. Apply techniques to eliminate the materials responsible for the caking of such dehydrated juices upon storage at high temperatures.

Supporting agency address information: AMC Natick Development Center, Natick, Ma. 01760

SUPPORTED BY U.S. Dept. of Defense - Army

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

No abstracts in this category.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N75-32998 West Virginia Univ., Morgantown.
ANALYSIS OF CIRCULATION CONTROLLED AIRFOILS Ph.D. Thesis
Edward Harold Gibbs 1975 197 p
Avail: Univ. Microfilms Order No. 75-21943

A self-contained analysis for arbitrary circulation controlled airfoils in incompressible flow was developed. The analysis predicts the blowing slot conditions required to produce a specified lift coefficient on a given airfoil with given free stream conditions. An iterative procedure is used to find the blowing slot conditions that allow the Thwaites condition of constant pressure in the separated region to be satisfied. With the input given, a potential flow analysis is performed using the Theodorsen method. Boundary layer analyses for the lower and upper surfaces then yield the separation pressure on the lower surface and the boundary layer properties at the slot on the upper surface. The flow is initially laminar and usually becomes turbulent. The Cebeci, Smith finite difference method is used and an eddy viscosity model is used for turbulent flow. Blowing slot values are assumed and a turbulent wall jet analysis is performed to determine the wall pressure at separation on the upper surface. Dissert. Abstr.

N75-32999 West Virginia Univ., Morgantown.
HELICOPTER LIFTING SURFACE THEORY WITH FORCE FREE WAKE Ph.D. Thesis
Hsi Frank Chou 1975 147 p
Avail: Univ. Microfilms Order No. 75-21939

Steady potential flow nonlinear lifting surface theory is applied to an arbitrary helicopter rotor system in constant rotational and constant axial translational motion including hover. An unknown velocity doublet distribution is imposed on both the blade and wake surfaces, satisfying the normal boundary conditions on the true wetted surface and the Kutta condition at the trailing edge. The governing equation, then, becomes a Fredholm integral equation of the first kind. A numerical scheme is developed to solve the doublet strength distribution by approximating the surface with a finite number of uniformly loaded elements and satisfying the boundary conditions at their centroids. The integral equation is thereby transformed into a system of linear algebraic equations. The solution provides the velocity magnitude and direction, and the pressures on the blade surface.
Dissert. Abstr.

N75-33000*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A MOMENTUM ANALYSIS OF HELICOPTERS AND AUTOGYROS IN INCLINED DESCENT, WITH COMMENTS ON OPERATIONAL RESTRICTIONS
Harry H. Heyson Washington Oct. 1975 82 p refs
(NASA-TN-D-7917; L-10045) Avail: NTIS HC $4.75 CSCL 01A

A momentum theory was developed for rotors in descending flight. Comparison with available experimental data indicates that the theory, when properly interpreted, yields the optimum performance of the rotor. Power settling can be explained on the basis of the theory. The reasons and the need for operational restrictions on descending flight are discussed. The maximum autorotative performance of a rotor is determined; the theory shows good agreement with flight measurements in autorotation. Similar equations were developed for a wing; it was shown that the ideal performance of an autorotating rotor is identical to that of a wing of equal aspect ratio. A limiting maximum wing lift coefficient which is confirmed by existing experimental data was obtained.
Author

N75-33001*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF WALL SUCTION ON PERFORMANCE OF A SHORT ANNULAR DIFFUSER AT INLET MACH NUMBERS UP TO 0.5
Albert J. Juhasz Washington Oct. 1975 24 p refs
(NASA-TM-X-3302; E-8393) Avail: NTIS HC $3.25 CSCL 20D

A short annular diffuser equipped with wall bleed (suction) capability was evaluated at inlet Mach numbers of 0.186 to 0.5. The diffuser had an area ratio of 4.0 and a length-to-inlet height ratio of 1.6. Test results show that the exit velocity profiles, typical of annular jet flow without suction, could be considerably flattened by application of wall suction. This improved performance was also reflected in diffuser effectiveness (static-pressure recovery) and total-pressure loss results. At the inlet Mach number of 0.5 diffuser static-pressure recovery is equal to or better than at lower inlet Mach numbers for comparable suction rates.
Author

N75-33002*# Kanner (Leo) Associates, Redwood City, Calif.
THEORY OF INDUCTION OF A HEAVILY LOADED PROPELLER
E. D. Safronov Washington NASA Oct. 1975 16 p refs Transl. into ENGLISH from Uch. Zap. (USSR), v. 4, no. 4, 1973 p 99-107
(Contract NASw-2790)
(NASA-TT-F-16612) Avail: NTIS HC $3.25 CSCL 01A

A heavily loaded propeller theory is developed on the basis of exact solutions obtained within the framework of the theory of a weakly loaded propeller. Expressions are derived for the components of the velocity induced at an arbitrary point in space

by a heavily loaded propeller. The expressions are useful in the solution of various propeller interference problems. Author

N75-33003*# Boeing Vertol Co., Philadelphia, Pa.
FEASIBILITY STUDY OF MODERN AIRSHIPS, PHASE 1, VOLUME 1 Final Report
B. Joner May 1975 457 p refs
(Contract NAS2-8693)
(NASA-CR-137691-Vol-1; D210-10953-1-Vol-1) Avail: NTIS HC $11.50 CSCL 01B

The history of the airship is examined from a technical and operational/mission point of view. The impact on a modern airship design by present technology is defined in some selected, representative areas through a comparison between 1930 and 1975 state-of-the-art. A survey of missions with a potential for the airship was made and some viable applications are established. Several concepts of modern airships were taken through a parametric design analysis in the missions previously established, evolving in a new configuration of a hybrid airship - the Helipsoid -, combining static lift and dynamic lift from tilting propeller/rotors and the planform. Cruise speeds in the 150-200 kt (77-103 m/s) will be possible with this configuration with reasonable engine power. The Helipsoid offers at the same time a realistic and practicable solution to the ballast problem, which is inherent in a vehicle generating its lift (fully or partially) from a medium lighter than air. Author

N75-33004*# Boeing Vertol Co., Philadelphia, Pa.
DESCRIPTION OF CASCOMP COMPREHENSIVE AIRSHIP SIZING AND PERFORMANCE COMPUTER PROGRAM, VOLUME 2
Jon Davis May 1975 304 p refs
(Contract NAS2-8693)
(NASA-CR-137691-Vol-2; D210-10953-2-Vol-2) Avail: NTIS HC $9.25 CSCL 01B

The computer program CASCOMP, which may be used in comparative design studies of lighter than air vehicles by rapidly providing airship size and mission performance data, was prepared and documented. The program can be used to define design requirements such as weight breakdown, required propulsive power, and physical dimensions of airships which are designed to meet specified mission requirements. The program is also useful in sensitivity studies involving both design trade-offs and performance trade-offs. The input to the program primarily consists of a series of single point values such as hull overall fineness ratio, number of engines, airship hull and empennage drag coefficients, description of the mission profile, and weights of fixed equipment, fixed useful load and payload. In order to minimize computation time, the program makes ample use of optional computation paths. Author

N75-33005*# Transemantics, Inc., Washington, D.C.
DEPENDENCE OF LOCAL INTERACTION PARAMETERS ON THE KNUDSEN NUMBER
S. N. Alekseyeva and R. N. Miroshin Washington NASA Sep. 1975 13 p refs Transl. into ENGLISH from Aerodin. Razrezh. Gazov (Leningrad), no. 7, 1974 p 180-190
(Contract NASw-2792)
(NASA-TT-F-16574) Avail: NTIS HC $3.25 CSCL 20D

The drag coefficients of a circular cylinder, a sphere, and a cone are calculated on the basis of an interpolation formula over the entire range of Knudsen numbers. The analytical values are compared with drag data obtained in a low-density wind tunnel at Mach numbers greater than 4. Author

N75-33006# National Aviation Facilities Experimental Center, Atlantic City, N.J.
INVESTIGATION OF THE VORTEX WAKE CHARACTERISTICS OF JET TRANSPORTS DURING CLIMBOUT AND TURNING FLIGHT Final Report, Oct. - Nov. 1973
Leo J. Garodz and Nelson J. Miller May 1975 118 p refs
(FAA Proj. 975-430-003)
(AD-A012383/6; FAA-NA-74-30; FAA-AEQ-75-1) Avail: NTIS HC $5.75 CSCL 20/4

The characteristics of the trailing vortices of several large propeller and jet transport aircraft were investigated. This investigation centered around jet transport vortex persistence and movement during noise abatement-type departure operations at the Los Angeles International Airport and how approaching aircraft could avoid these vortices. It is concluded that the results and conclusions would be applicable to similar operations at other airports. The study is primarily based upon full-scale flight tests of vortex characteristics and their effect on encountering aircraft. Special flight tests for vortex investigations of the B727 during noise abatement climbouts, straightaway and turning flight, in takeoff and clean configuration are included. Vortex-generating aircraft include C5A, B747, B707, B727, DC7, CV880, and Lincoln; vortex probe aircraft included CV990, B737, Learjet 23, DC9, and Devon. A vortex avoidance zone was developed which has an active life of 2 minutes when below 5,000 feet above ground level and 2.6 minutes when higher than 5,000 feet above ground level. Author

N75-33007# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Forschungsbereich Stroemungsmechanik.
INVESTIGATIONS OF THE DISTURBED FLOW PATTERN WITHIN AND AT THE DISCHARGE FROM A HIGH-LOADED CENTRIFUGAL COMPRESSOR IMPELLER
Dietrich Eckardt and Klaus-Juergen Trueltzsch 25 Apr. 1975 31 p refs Sponsored in part by Forschungsver. Verbrennungskraftmaschinen e.V.
(DLR-FB-75-39) Avail: NTIS HC $3.75; DFVLR, Cologne DM 13,20

Results of detailed flow investigations on a centrifugal impeller with tip speeds of 300 m/sec, performed with a laser velocimeter, pressure-transducer and hot-wire probes, were presented. A developing wake region changes the potential theory flow pattern in the radial impeller. The subsequent pronounced distortion of the impeller discharge flow mixes out rapidly in the diffuser entry region. Author (ESA)

N75-33008# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
EXPERIMENTAL INVESTIGATIONS OF HEAT TRANSFER ON BLUNT CONES IN HYPERSONIC FLOWS AT VERY LOW DENSITIES
Farouk Bachour and Dieter Erdtel 27 Feb. 1975 55 p refs In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft
(DLR-FB-75-28) Avail: NTIS HC $4.25; DFVLR, Porz, West Ger. DM 21,10

Results of heat transfer measurements on blunt cones are reported. Ten degree cones with nose radii of 5 mm and 10 mm were chosen as models. The measurements were performed in flow conditions with Mach numbers between 13.4 and 15.1, mean free paths between 3.46 mm and 9.26 mm, and heat transfer rates between 32 and 105 kW/sq m. The results obtained at angles of attack up to 25 deg are compared with theoretical and other experimental data. Author (ESA)

N75-33009# Groupe des Recherches Ionospheriques, Paris (France).
STRATOSPHERIC BALLOONS AND LAUNCH CONDITIONS IN TERRE ADELIE [RAPPORT SUR LES CONDITIONS DE LANCEMENTS ET DE VOLS DE BALLONS STRATOSPHERIQUES EN TERRE ADELIE]
J. P. Legrand, J. Garnier (Meteorol. Natl.), and R. Raymond (CNES, Aire sur l'Adour, France) 30 Jun. 1973 39 p In FRENCH
(GRI/NT/88) Avail: NTIS HC $3.75

The meteorological parameters required for proper launch conditions are discussed and a criterion for wind drop forecast lasting at least three hours was found. The conditions to be fulfilled by the launching pad are discussed. The results of nine launches are detailed and hypotheses are given for the reasons for unexpected behavior of the balloons. ESA

N75-33010# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
INCOMPRESSIBLE, INVISCID, SYMMETRICAL FLOW ABOUT ELLIPSOIDS. COMPARISON OF AN APPROXIMATE THEORY WITH EXACT RESULTS
S. Costi and H. Portnoy Dec. 1974 55 p refs
(Grant AF-AFOSR-2145-71; AF Proj. 9781)

(AD-A010481; TAE-233; SR-5; AFOSR-75-0620TR) Avail: NTIS CSCL 01/1

In an earlier report, a first-order theory for thin lifting wings was developed which is uniformly valid near the rounded wing-leading-edges and tips and is also uniformly valid near the effectively rounded edges of the wing wake (assuming an effective displacement boundary to the wake). In this report the method is applied to find the flow on the surface of a thin ellipsoid, without wake, at zero angle of attack and yaw, and the results are compared with those obtained from the classical exact potential theory for ellipsoids. Good agreement is found on the whole, and a few questionable results are shown to be due to the use of a numerical differentiation procedure. It is recommended that the calculation be modified so as to remove the necessity for numerical differentiation. GRA

N75-33011# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

CALCULATION OF THE AERODYNAMIC EFFECTS OF CERTAIN VORTEX SUPPRESSING DEVICES

H. Portnoy Dec. 1974 38 p refs

(Grant AF-AFOSR-2145-71; AF Proj. 9781)

(AD-A010482; TAE-235; SR-6; AFOSR-75-0713TR) Avail: NTIS CSCL 01/1

There has been a recent increase of interest in devices for accelerating the dissipation of wing-tip trailing vortices. A number of experimental programs have been carried out to determine the effectiveness of various devices, such as tip-mounted jets, small windmills, suitably disposed vortex generators and so on, in increasing the rate of vortex decay. Only limited attention seems to have been paid to the effects of these devices on the wing aerodynamic properties and the work that has been done appears to be entirely experimental. It is the purpose of the present paper to propose three simple mathematical models which may be used to assess many of the current suppressors, from the viewpoint of wing property modification. GRA

N75-33012# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.

PROJECT SQUID Semiannual Progress Report, 1 Oct. 1974 - 30 Mar. 1975

T. Adamson, F. Browand, E. Bruce, F. Carta, and J. Penn Apr. 1975 84 p refs

(Contract N00014-67-A-0226-0005; NR Proj. 098-038)

(AD-A010225) Avail: NTIS CSCL 20/4

Reports of progress during the past six months on the 17 research programs comprising Project SQUID are presented. The research programs fall into the areas of Aerodynamics and Turbo Machinery, Combustion and Chemical Kinetics, Measurements and Turbulence. Project SQUID is a cooperative program of basic research related to jet propulsion. GRA

N75-33013# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AN ANALYSIS OF THE PLANE SLIGHTLY DAMPED OSCILLATIONS OF A PARACHUTE IN FREE STEADY DESCENT

A. A. Shilov 15 Jan. 1975 28 p refs Transl. into ENGLISH from Tsentr. Aerogidrodinamicheskii Inst. Uch. Zap. (USSR), v. 4, no. 1, 1973 p 137-1437-143

(AD-A006563; FTD-MT-24-0510-75) Avail: NTIS CSCL 01/2

The linearized equations of motion are examined of an axisymmetric parachute of fixed geometry taking into account the effect of the virtual mass of air. It is shown that the decrement of angular oscillation damping is determined by a cubic equation. GRA

N75-33014# Michigan Univ., Ann Arbor. Dept. of Naval Architecture and Marine Engineering.

EXPERIMENTAL ANALYSIS OF A TWO-DIMENSIONAL CAPTURED AIR BUBBLE Final Report, 1 Oct. 1972 - 30 Sep. 1974

Susan O. Atkins Dec. 1974 36 p refs

(Contract N00014-67-A-0181-0054; SR0230101)

(AD-A009301; Rept-166) Avail: NTIS CSCL 13/10

A prediction of the added mass and damping of a heaving, two-dimensional, captured air bubble, published by Ogilvie in 1969, is verified, within limits, by the experiment discussed in this paper. Only the depth of the lip, relative to the width of the bubble, appears to exert a strong influence on the results. GRA

N75-33015# Naval Postgraduate School, Monterey, Calif.

A RESEARCH STUDY OF THE ROTARY WING TEST AND EVALUATION SEGMENTS AT THE NAVAL AIR TEST CENTER, PATUXENT RIVER, MARYLAND M.S. Thesis

Bruce Leon Valley Jun. 1975 105 p refs

(AD-A010796) Avail: NTIS CSCL 01/3

This study examined the organizational and aircraft maintenance problems of the rotary wing segments within the organizations at the Naval Air Test Center, Patuxent River, Maryland. A static and dynamic analysis was conducted, a model of a consolidated rotary wing organization constructed, and a questionnaire distributed, collected, and evaluated to determine the attitudes of various NATC personnel groups, military and civilian, toward pertinent issues. A critical analysis was also conducted of the new NATC mission-oriented directorate organization scheduled for implementation on 1 Apr 1975. GRA

N75-33016# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RESULTS OF THE MEASUREMENT OF THE MUTUAL SPECTRA OF THE NEAR-WALL PULSATIONS OF THE PRESSURE OF TURBULENT BOUNDARY LAYER

B. M. Efimtsov and S. E. Shubin 7 Feb. 1975 21 p refs Transl. into ENGLISH from Uch. Zap. Tsentr. Aerogidrodinamicheskii Inst. (USSR), v. 3, no. 4, 1972 p 126-129

(AD-A007202; FTD-MT-24-0559-75) Avail: NTIS CSCL 01/1

The measurements were on a smooth surface with zero pressure gradient in the range of M = 0.35 to 3.5, and R = 0.5 x 10 to the 8th power to 1.9 x 10 to the 8th power. It is shown that the phase velocity to the velocity at the boundary layer does not depend on the flow parameters. Author

N75-33998 National Research Council of Canada, Ottawa (Ontario). National Aeronautical Establishment.

LIFT

W. E. Laundry *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab., 1 Apr. - 30 Jun. 1975 30 Jun. 1975 p 1-10 refs (For availability see N75-33997 24-99)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N75-33017# National Aviation Facilities Experimental Center, Atlantic City, N.J. ATC Systems Div.

THE USE OF DYNAMIC SEARCH AREAS IN THE NATIONAL AIRSPACE SYSTEM ENROUTE COMPUTER PROGRAM Interim Report, Jul. - Nov. 1974

Francis R. Mullin May 1975 20 p refs

(AD-012398/4; FAA-NA-75-152; FAA-RD-75-77) Avail: NTIS HC $3.25 CSCL 17/7

The use of online computed search areas in the National Airspace System (NAS) enroute tracking algorithm is investigated. The search areas currently used in the enroute model 3d2 computer program are of fixed values, and cannot provide turn detection precise enough to make use of the track-oriented smoothing feature of the NAS bimodal tracker. The results indicate that the dynamic search areas provide superior performance to the method currently specified. Author

N75-33018# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.

AIRCRAFT ACCIDENT REPORT: TRANS WORLD, AIRLINES, INC., BOEING 707-331B, N8734 IN THE IONIAN SEA

26 Mar. 1975 44 p

(PB-241705/3; NTSB-AAR-75-7) Avail: NTIS HC $3.75 CSCL 01B

At 0940 Greenwich mean time, September 8, 1974, Trans World Airlines, Inc., Flight 841, crashed into the Ionian Sea about 50 nmi west of Cephalonia, Greece. There were 79 passengers and 9 crewmembers on board; no one survived. The aircraft was destroyed. The National Transportation Safety Board determines that the probable cause of this accident was the detonation of an explosive device within the aft cargo compartment of the aircraft which rendered the aircraft uncontrollable. GRA

N75-33019# Honeywell, Inc., Minneapolis, Minn.
AVOID-1 COLLISION AVOIDANCE SYSTEM (M) Final Report, 23 Jan. - 31 Jan. 1974
R. G. Dexter 1974 187 p
(Contracts N62269-73-C-0487; DOT-FA73WAI-358)
(AD-A002492; YG1132A01) Avail: NTIS CSCL 17/7

A detailed description of the work performed on the AVOID-I collision avoidance system is provided. The AVOID-I receiver/transponder, traffic simulator and digital display interface units operation and hardware descriptions are provided in detail. Test procedures developed for the system and test results are included. The system has been delivered to the Naval Air Development Center, Warminster, Pennsylvania, for flight test purposes. GRA

N75-33020# Peat, Marwick, Mitchell and Co., San Francisco, Calif.
REVIEW OF AVIATION FORECASTS AND FORECASTING METHODOLOGY
Dan G. Haney May 1975 61 p refs
(Contract DOT-OS-40176)
(PB-242249/1; DOT-40176-6) Avail: NTIS HC $4.25 CSCL 01B

A briefing to a special committee appointed by the Secretary of Transportation to study the organizational structure and management approach employed by the Federal Aviation Administration in carrying out its missions is documented. The uses are covered of aviation forecasts, the methodologies used in developing forecasts, and a comparison of past forecasts with actual resulting aviation activity. Past uses of aviation forecasts are numerous; however, it is shown that some major policy studies in the past have not incorporated forecasts of aviation activity as part of the analytical process used in reaching recommendations. The methodology used to develop forecasts varies widely, depending on a number of factors. GRA

N75-33021# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORTS. BRIEF FORMAT. US CIVIL AVIATION ISSUE NUMBER 2 OF 1974 ACCIDENTS
15 Nov. 1974 560 p
(PB-242469/5; NTSB-BA-74-6) Avail: NTIS HC $13.00 CSCL 01B

The publication contains selected aircraft accident reports, in brief format, occurring in U.S. civil aviation operations during calendar year 1974. The 896 general aviation accidents represent a random selection. The publication is issued irregularly, normally six times each year. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N75-33022*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
CONVERSION OF FORMULAS FOR THE RECTANGULAR COORDINATES OF CONFORMAL PROJECTIONS USED IN AIR NAVIGATION
B. V. Zolin Washington NASA Aug. 1975 10 p refs Transl. into ENGLISH from Izv. VUZ, Geod. i Aerofotosyemka (USSR), no. 4, 1974 p 121-125
(Contract NASw-2789)
(NASA-TT-F-16528) Avail: NTIS HC $3.25 CSCL 17G

Automatic navigation and control of moving objects and their position location on maps are examined. Special attention was given to the problem of converting the object's current geographic coordinates into rectangular coordinates by using the catographic projection formulas which comprise the map. It was noted that according to Chebyshev's theorem, the most useful conformal projections for different geographic zones are: cylindrical for the equatorial zone, conical for middle latitudes, and stereographic for the polar regions. E.H.W.

N75-33023# Eastern Air Lines, Inc., Miami, Fla.
OCEANIC AIR ROUTE NAVIGATION WITH CYCLE MATCH LORAN-C Final Report, Oct. 1974 - Jan. 1975
William S. Gillis Apr. 1975 55 p
(Contract DOT-FA74WA-3534)
(AD-A011210/2; FAA-RD-75-74) Avail: NTIS HC $4.25 CSCL 17/7

A Loran-C cycle matching receiver was evaluated in line service to determine its qualification as a potential replacement for Loran-A. The receiver and associated components were installed on an Eastern Air Lines L1011 aircraft, and data were collected by a qualified navigator on the routes between the U.S. mainland and Puerto Rico. Results of the program indicate that cycle matching Loran-C is a satisfactory substitute for Loran-A where usable signals are available. The equipment under evaluation provided excellent accuracy and required less flight crew attention than is normally demanded by the present Loran-A systems. Author

N75-33024# Lincoln Lab., Mass. Inst. of Tech., Lexington.
NETWORK MANAGEMENT
H. F. Vandevenne 16 May 1975 102 p refs
(Contract DOT-FA72WAI-261; FAA Proj. 034-241-012)
(AD-A012398/4; ATC-45; FAA-RD-75-8) Avail: NTIS HC $5.25 CSCL 17/7

The design of the discrete address beacon system network management function is presented. Network management is responsible for the interaction between the local sensor and the adjacent connected sensors. Based on a dynamic interpretation of the coverage map and the status of the network, network management determines (1) the coverage responsibility of the local sensor, (2) which other sensors are covering the same area, and (3) which of the sensors has principal data link responsibility. Interaction is effected through message exchange over ground communication links connecting the DABS sensors. Author

N75-33025# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEVELOPMENT OF A DISCRETE ADDRESS BEACON SYSTEM Quarterly Technical Summary, 1 Jan. - 31 Mar. 1975
1 Apr. 1975 80 p
(Contract DOT-FA72WAI-261; FAA Proj. 034-241-012)
(AD-A010441/4; FAA-RD-75-67) Avail: NTIS HC $4.75 CSCL 17/7

Results of analytical studies, laboratory and flight experiments, and software developments supporting the concept feasibility and performance definition phase of the discrete address beacon system (DABS) are discussed. Topics discussed include design and analysis, environmental characterization, IPC/PWI flight tests, experimental facility upgrading and operation, and design validation. Author

N75-33026# Computer Sciences Corp., Falls Church, Va.
RADIO NAVIGATION STUDY, VOLUME 1 Final Report
G. Frankel, R. Weirich, M. Denman, and J. Bisaga Feb. 1975 62 p refs
(Contract TP-4AC003)

(AD-A010114) Avail: NTIS CSCL 17/7

A study of existing and planned United States radio navigation systems and requirements was conducted. The purposes of this study have been to gather requirements and systems characteristics, to investigate methods of grouping or organizing requirements and systems in a coherent logical structure, to identify gaps in system capability to meet requirements and areas where overlaps in capability occur, and finally to define some alternative future integrated systems in order to illuminate key issues that should be further studied to improve future radio navigation system management. Approximately 70 requirements were identified along with some 80 systems or system variants. A number of conclusions were reached concerning issues that need to be examined. GRA

N75-33027# Computer Sciences Corp., Falls Church, Va.
RADIO NAVIGATION STUDY. VOLUME 2: APPENDICES A AND B Final Report
G. Frankel, R. Weirich, M. Denman, and J. Bisaga Feb. 1975 148 p
(Contract TP-4AC003)
(AD-A010115) Avail: NTIS CSCL 17/7

A study of existing and planned United States radio navigation systems and requirements was conducted. The purposes of this study have been to gather requirements and systems characteristics, to investigate methods of grouping or organizing requirements and systems in a coherent logical structure, to identify gaps in system capability to meet requirements and areas where overlaps in capability occur, and finally to define some alternative future integrated systems in order to illuminate key issues that should be further studied to improve future radio navigation system management. Approximately 70 requirements were identified along with some 80 systems or system variants. A number of conclusions were reached concerning issues that need to be examined. Author

N75-33028*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
A FINITE-STATE, FINITE-MEMORY MINIMUM PRINCIPLE, PART 2 Interim Report
Nils R. Sandell, Jr. and Michael Athans 1975 28 p refs
(Grants NGL-22-009-124; AF-AFOSR-2273-72; NSF HGK-25781; NSF HGK-41647; AF Proj. 9769)
(NASA-CR-119163; AD-A010496; ESL-P-592-Pt-2; AFOSR-75-0715TR) Avail: NTIS HC $3.75 CSCL 12/2

In part 1 of this paper, a minimum principle was found for the finite-state, finite-memory (FSFM) stochastic control problem. In part 2, conditions for the sufficiency of the minimum principle are stated in terms of the informational properties of the problem. This is accomplished by introducing the notion of a signaling strategy. Then a min-H algorithm based on the FSFM minimum principle is presented. This algorithm converges, after a finite number of steps, to a person - by - person extremal solution. GRA

N75-33029# Institute for Telecommunication Sciences, Boulder, Colo.
PROBABILISTIC INTERFERENCE PREDICTION MODEL-COMPUTER PROGRAMS Final Report, Jan. 1974 - Jan. 1975
John R. Juroshek Feb. 1975 105 p
(Contract DOT-FA74WAI-441)
(AD-A011453/8; FAA-RD-75-33) Avail: NTIS HC $5.25 CSCL 17/2

A statistical method is described for predicting interference between air traffic control frequency assignments in the VHF aeronautical mobile frequency band. This procedure results in a probability of interference representing the statistical chances of interference occurring between two air traffic control sectors operating on co-channel or adjacent channel frequency assignments. The model accounts for both the spatial distribution of the interfering aircraft as well as the statistical nature of voice communications. Two computer programs are described for computing probability of interference given the pertinent geometry of the victim and interfering sectors as well as their air/ground channel utilization figures. One of the computer programs uses Monte-Carlo methods to arrive at the answer while the other solves a deterministic set of equations to obtain an approximate solution at a considerable savings in computer execution time. The problem is examined of probability of interference given multiple interfering air traffic control sectors. It is concluded that for small victim sectors the source of interference is very likely to be one particular interfering sector. Large victim sectors, however, can experience nearly equal interference from more than one sector. Author

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N75-33030 Stanford Univ., Calif.
WEIGHT OPTIMIZATION UNDER FLUTTER CONSTRAINT Ph.D. Thesis
Solly Andy Segenreich 1975 112 p
Avail: Univ. Microfilms Order No. 75-21897

A new approach to the weight minimization of wings subjected to a flutter speed constraint is the main topic. The use of the flutter speed directly as a constraint is replaced by the vanishing of the damping factor condition. Besides the computational advantages of such an approach, especially in the treatment of compressible aerodynamic models, relatively simple optimality condition equations valid for both incompressible and compressible flows can be easily derived. A second topic is the implementation of a hybrid structural optimization algorithm which attempts to combine the simplicity of the optimality criteria methods with the monotonic weight decrease behavior of the direct descent methods. Encouraging results are presented. Finally, the viability of using assumed modes in static optimization is briefly discussed and one comparative example is given. Dissert. Abstr.

N75-33031*# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
STUDY TO INVESTIGATE DESIGN, FABRICATION AND TEST OF LOW COST CONCEPTS FOR LARGE HYBRID COMPOSITE HELICOPTER FUSELAGE, PHASE 1 Final Report, Aug. 1974 - Jun. 1975
K. M. Adams and J. J. Lucas Jun. 1975 99 p refs
(Contract NAS1-13479)
(NASA-CR-132731; SER-50944) Avail: NTIS HC $4.75 CSCL 01C

The development of a frame/stringer/skin fabrication technique for composite airframe construction was studied as a low cost approach to the manufacture of large helicopter airframe components. A center cabin aluminum airframe section of the Sikorsky CH-53D helicopter was selected for evaluation as a composite structure. The design, as developed, is composed of a woven KEVLAR-49/epoxy skin and graphite/epoxy frames and stringers. To support the selection of this specific design concept a materials study was conducted to develop and select a cure compatible graphite and KEVLAR-49/epoxy resin system, and a foam system capable of maintaining shape and integrity under the processing conditions established. The materials selected were, Narmco 5209/Thornel T-300 graphite, Narmco 5209/KEVLAR-49 woven fabric, and Stathane 8747 polyurethane foam. Eight specimens were fabricated, representative of the frame, stringer, and splice joint attachments. Evaluation of the results of analysis and test indicate that design predictions are good to excellent except for some conservatism of the complex frame splice. Author

N75-33032*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF A LINEAR WASHOUT FOR SIMULATOR MOTION CUE PRESENTATION DURING LANDING APPROACH
Russell V. Parrish and Dennis J. Martin, Jr. (Electronic Assoc., Inc., Hampton, Va.) Washington Oct. 1975 56 p refs
(NASA-TN-D-8036; L-9984) Avail: NTIS HC $4.25 CSCL 01C

The comparison of a fixed-base versus a five-degree-of-

freedom motion base simulation of a 737 conventional take-off and landing (CTOL) aircraft performing instrument landing system (ILS) landing approaches was used to evaluate a linear motion washout technique. The fact that the pilots felt that the addition of motion increased the pilot workload and this increase was not reflected in the objective data results, indicates that motion cues, as presented, are not a contributing factor to root-mean-square (rms) performance during the landing approach task. Subjective results from standard maneuvering about straight-and-level flight for specific motion cue evaluation revealed that the longitudinal channels (pitch and surge) possibly the yaw channel produce acceptable motions. The roll cue representation, involving both roll and sway channels, was found to be inadequate for large roll inputs, as used for example, in turn entries. Author

N75-33033# Texas A&M Research Foundation, College Station. Flight Mechanics Lab.
DEVELOPMENT OF STALL DETERRENT CONCEPTS FOR GENERAL AVIATION AIRCRAFT Final Report, Jun. 1974 - Feb. 1975
H. L. Chevalier, C. R. Gallaway, and J. R. Brown Feb. 1975 152 p refs
(Contract DOT-FA74WA-3516)
(AD-A012386/9; FAA-RD-75-52) Avail: NTIS HC $6.25 CSCL 01/3

The feasibility of five approaches to develop an airplane stall deterrent device was determined. The static longitudinal stability and control characteristics of a typical light single-engine and twin-engine airplane were obtained and modified with each stall deterrent device. These characteristics were compared to those of an ideal stall deterrent airplane. The five approaches to stall deterrence were the use of a segmented elevator, an auxiliary horizontal tail, a trim tab on the horizontal tail surface, an auxiliary surface to deploy a spoiler on the horizontal tail, and changes in airplane design. The auxiliary horizontal tail was found to make an airplane stall deterrent and in many cases resulted in a stall proof airplane. It was found that the tab was an effective stall deterrent device on the light single-engine airplane. However, the tab stall deterrent device required the use of an angle of attack sensor and servo drive and would be as complex and costly as current stall deterrent devices. Both the auxiliary horizontal tail and the auxiliary surface to deploy a spoiler device have advantages over current stall deterrent devices and potential for further development. A test plan for the development of these devices is given in the report. Author

N75-33034# Boeing Co., Wichita, Kans.
FAAJT3D QUIET NACELLE RETROFIT FEASIBILITY PROGRAM. VOLUME 2: UPPER GOAL GROUND TESTING Final Report, Jul. 1971 - Mar. 1974
L. L. Linscheid, J. E. Mayer, and H. F. Veldman Apr. 1974 187 p refs
(Contract DOT-FA71WA-2628)
(AD-A012969/2; D3-9042-3; FAA-RD-73-131-Vol-2) Avail: NTIS HC $7.00 CSCL 01/3

Model and full scale ground tests were performed on the JT3D quiet nacelle to provide insight and technical background relating to acoustic and propulsion performance of plug nozzles. The information thus obtained was used in the design of the full scale hardware. Full scale engine ground tests were performed on two configurations of the upper goal quiet nacelle to determine its acoustic and propulsion performance. Author

N75-33035# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
OPTIMISATION OF AEROPLANE UNDERCARRIAGES USING HYBRID COMPUTING FACILITY, PART 1 Final Report, 1 Oct. 1972 - 30 Sep. 1974
M. R. Whitehead Dec. 1974 145 p refs 2 Vol.
(Contract MIN-DEF/AT/2170/036/RDT)
(TT-7414-Pt-1) Avail: NTIS HC $5.75

A hybrid computer technique is described, with which optimization of undercarriage characteristics is attempted in order to create an improved vibration environment in an airframe. The airframe/undercarriage model is represented in two dimensions and includes all the nonlinearities associated with an undercarriage shock absorber. Inputs to the model are provided by measured runway profiles and include aerodynamic influences. A measure of performance is postulated which considers the ride comfort of passengers and crew and stress and fatigue damage in the airframe. Limitations of the hybrid computing system with respect to automatic optimization are discussed, and alternative methods are considered. It is shown that without the automatic optimization procedure, a very simple to use, flexible and efficient design tool remains. Author (ESA)

N75-33036# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
OPTIMISATION OF AEROPLANE UNDERCARRIAGES USING HYBRID COMPUTING FACILITY, PART 2
M. R. Whitehead Dec. 1974 269 p 2 Vol.
(TT-7414-Pt-2) Avail: NTIS HC $8.50

Equations of motion are derived for aircraft undercarriage modelling using the method of Lagrange. Maximum scale factors for an analog computer program used for simulating a two-dimensional model are listed together with dimensional data typical of current supersonic transport design. Listings of digital computer programs are presented. ESA

N75-33037# General Dynamics/Fort Worth, Tex.
OPERATIONAL SOFTWARE CONCEPT (PHASE ONE). VOLUME 1: INTRODUCTION AND SUMMARY Final Report, May 1973 - May 1974
James D. Engelland Wright-Patterson AFB, Ohio AFAL 28 May 1974 122 p refs 5 Vol.
(Contract F33615-73-C-1209; AF Proj. 2003)
(AD-A010414; AFAL-TR-74-168-Vol-1) Avail: NTIS CSCL 01/3

The cost and complexity of avionics software is examined in terms of defining new and innovative approaches for production of operational flight programs. An integrated approach to design is developed which uses a HOL source language, graphical design aids, structured programming discipline, coordinated testing, and modularity techniques to produce reliable, reusable, well documented operational flight programs. Innovative ideas include a new perspective of executive functions and a modified view of the role played by support software in the design process. Author

N75-33038# General Dynamics/Fort Worth, Tex.
OPERATIONAL SOFTWARE CONCEPT (PHASE ONE). VOLUME 2: OPERATIONAL SOFTWARE DESCRIPTION DOCUMENT Final Report, May 1973 - May 1974
James D. Engelland Wright-Patterson AFB, Ohio AFAL 26 May 1974 409 p 5 Vol.
(Contract F33615-73-C-1209; AF Proj. 2003)
(AD-A010415; AFAL-TR-74-168-Vol-2) Avail: NTIS CSCL 01/3

The operational avionics software structure is described. The processes for design, development, testing, and use of avionics software are discussed along with flow-graph theory. The functions and structure of applications, executive, and support software are included. GRA

N75-33039# General Dynamics/Fort Worth, Tex.
OPERATIONAL SOFTWARE CONCEPT (PHASE ONE). VOLUME 3: HIGHER ORDER LANGUAGE SELECTION Final Report, May 1973 - May 1974
James D. Engelland Wright-Patterson AFB, Ohio AFAL 26 May 1974 170 p refs 5 Vol.
(Contract F33615-73-C-1209; AF Proj. 2003)
(AD-A010416; AFAL-TR-74-168-Vol-3) Avail: NTIS CSCL 01/3

This volume, the third of five, describes the evaluation and selection method used to rank higher order languages for possible use in coding OSC routines. Ten general purpose higher order languages were compared and ranked according to their desirability and applicability to (1) the overall OSC programming task, (2) the Phase Two demonstration task, (3) use as an applications programming language, (4) use as an executive-writing language, and (5) use as the system integrator language. JOVIAL (J3B) was selected as the best candidate for the Phase Two task, and the development of a new language was recommended for the long-term use of OSC. GRA

N75-33040# General Dynamics/Fort Worth, Tex.
OPERATIONAL SOFTWARE CONCEPT (PHASE ONE). VOLUME 4: DEMONSTRATION METHODS Final Report, May 1973 - May 1974
James D. Engelland Wright-Patterson AFB, Ohio AFAL 26 May 1974 125 p 5 Vol.
(Contract F33615-73-C-1209; AF Proj. 2003)
(AD-A010417; AFAL-TR-74-168-Vol-4) Avail: NTIS CSCL 01/3

This volume, the fourth of five, describes plans and objectives for the Phase Two effort which were developed during Phase One. Computers and missions for demonstration were considered, along with methods to use the demonstration to satisfy all Phase Two objectives. Two computers, the Singer SKC-2000, a multiprocessor, and the IBM 4-Pi CP-2, a uniprocessor, were recommended for the demonstration. Also, two missions, air superiority and deep interdiction/strategic bombing, were recommended for the demonstration. GRA

N75-33041# General Dynamics/Fort Worth, Tex.
OPERATIONAL SOFTWARE CONCEPT (PHASE ONE). VOLUME 5: BIBLIOGRAPHY Final Report, May 1973 - May 1974
James D. Engelland Wright-Patterson AFB, Ohio AFAL 26 May 1974 244 p refs 5 Vol.
(Contract F33615-73-C-1209; AF Proj. 2003)
(AD-A010418; AFAL-TR-74-168-Vol-5) Avail: NTIS CSCL 01/3

As new aircraft are being developed, greater demands are being placed on their information processing systems to automate more mission functions. The computer software required to accomplish this task, however, continues to plague the Air Force in the problem areas of risk, visibility, and cost. Existing avionics software is inadequately structured, documented and tested. It remains inflexible (incapable of easy changes for different missions) and nontransferable (incapable of being used by several aircraft). This volume, the last of five, is a bibliography of publications relating to the OSC effort. It includes a list of titles, abstracts, and comments concerning the articles. Entries are arranged alphabetically by title. GRA

N75-33042# RAND Corp., Santa Monica, Calif.
IDEAS FOR USAF RPV DEVELOPMENT (A TRANSCRIPT OF AN INFORMAL TALK)
W. B. Graham Jul. 1974 11 p
(AD-A010979; P-5329) Avail: NTIS CSCL 01/3

Suggested is a philosophy of RPV development, leading to a plan of action: build some very simple, cheap systems, test them and learn from the tests. Then go on to build some other types, extending their range or whatever performance measure seems to be most important based on the tests of the earlier RPVs. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N75-33043# Ohio State Univ. Research Foundation, Columbus.
DEVELOPMENT OF STALL DETERRENT DEVICE FOR SMALL AIRPLANES Final Report, 26 Jun. 1974 - 25 Jan. 1975
Richard D. Gilson and Robert W. Fenton Jun. 1975 64 p refs
(Contract DOT-FA74WA-3515)
(AD-A012387/7; RF-3962; FAA-RD-75-53) Avail: NTIS HC $4.25 CSCL 01/4

The effectiveness of a kinesthetic-tactual display as a flight control aid is discussed. Angle of attack information is presented to the pilot, via the display, during critical operational phases, thus, providing a continuous indication of aerodynamic state. It is concluded that the necessary control is achieved with the aid of this display before a stall condition is reached. Author

N75-33044# Technisch Physisch Dienst TNO-TH, Delft (Netherlands).
MEASUREMENT OF THE FOCAL DISTANCE OF THE WINDSHIELD OF A NF-5 AIRCRAFT
E. Sies and D. VanNoortwijk 18 Dec. 1974 12 p
(TPD-1974-0-5; TDCK-65674) Avail: NTIS HC $3.25

The cockpit windshields of jet fighters are curved in one direction, and act as negative cylinder lenses. Parallax of a gunsight reticle can be avoided by focussing the reticle at the focal distance of the windshield instead of at infinity. The focal distance of the windshield of one NF-5 aircraft was measured, and is 30 to 35m for vertical picture details and definite (zero power) for horizontal picture details. Magnitude of error is calculated. A positive cylinder lens with a focal length of 3m would completely correct position error. ESA

N75-33045# Naval Postgraduate School, Monterey, Calif.
EVALUATION OF AN INTEGRATED ELECTRONIC INSTRUMENT DISPLAY FOR HELICOPTER HOVER OPERATIONS USING A SIX-DEGREE-OF-FREEDOM FIXED-BASE SIMULATION M.S. Thesis
Larry Richard Ammerman Mar. 1975 96 p refs
(AD-A010834) Avail: NTIS CSCL 01/4

The report discusses the development and evaluation of an integrated electronic instrument display designed to help alleviate pilot work load and improve aircraft control during the precision hover task while flying solely by reference to instruments. The evaluation uses a hybrid computer system to implement a six-degree-of-freedom fixed-base simulation of the SH-2F helicopter and a graphics processor to generate the integrated instrument display. Evaluation pilots were asked to rate the integrated display against conventional flight instruments after flying a simulated night over-water rescue mission. The evaluation revealed that the simulated aircraft dynamics were susceptible to pilot induced oscillations in a hover and, therefore, unsatisfactory for use as an evaluation tool. In general, the evaluation pilots considered the integrated display preferable to conventional cockpit instruments; however, further study is recommended since meaningful quantitative data were not obtained. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N75-33046# Lockheed Aircraft Corp., Burbank, Calif.
COMMERCIAL AIRCRAFT NOISE DEFINITION; L-1011 TRISTAR, VOLUME 1 Final Report, Jun. 1973 - Sep. 1974
Nathan Shapiro Sep. 1974 86 p refs 5 Vol.
(Contract DOT-FA73WA-3300)
(AD-A012371/1; LR-26075-Vol-1; FAA-EQ-74-6-1) Avail: NTIS HC $4.75 CSCL 01/3

Calculation procedures to describe airplane noise during takeoff and approach were programmed for batch operation on a large digital computer. Three routines are included. The first normalizes far-field noise spectra to reference conditions and then determines spectra at various distances from the airplane, for airport elevations between sea level and 6000 feet, and ambient temperatures between 30 F and 100 F. Overall sound pressure levels, A-weighted noise levels, perceived noise levels, and effective perceived noise levels are calculated. The second routine uses aerodynamic and engine thrust data to produce takeoff and approach flight path description. The basic takeoff is at constant equivalent airspeed, with thrust reduction or acceleration option after gear-up. The approach is along any constant glide slope between 3 and 6 degrees at constant airspeed, with a two-segment option. The last routine combines noise propagation and flight path information to produce constant noise contour footprints. Calculation procedures are presented in detail

for airplane noise characteristics, airplane performance, and community noise contours. Author

N75-33047# Lockheed Aircraft Corp., Burbank, Calif.
COMMERCIAL AIRCRAFT NOISE DEFINITION; L-1011 TRISTAR. VOLUME 2: L-1011-1 DATA Final Report, Jun. 1973 - Sep. 1974
Nathan Shapiro Sep. 1974 259 p 5 Vol.
(Contract DOT-FA73WA-3300)
(AD-A012372/9; LR-26075-Vol-2; FAA-EQ-73-6-2) Avail: NTIS HC $9.25 CSCL 01/3

The computer program for airplane performance and noise calculations was exercised to generate data in graphical and tabular form. The data and graphs are presented in four sections: noise characteristics including plots of effective perceived noise levels and A-noise levels versus distance at a number of thrust settings; takeoff performance in which the aerodynamic characteristics of the L-1011 were applied to produce takeoff performance data required to define airplane flyover distances for determining noise under the flight path; approach performance includes approach nomographs; and noise footprints includes sets of machine plotted constant noise contours prepared for representative takeoff and approach procedures. For Volume 1, see N75-33046. M.J.S.

N75-33048# Lockheed Aircraft Corp., Burbank, Calif.
COMMERCIAL AIRCRAFT NOISE DEFINITION; L-1011 TRISTAR. VOLUME 3: PROGRAM USER'S MANUAL Final Report, Jun. 1973 - Sep. 1974
Nathan Shapiro Sep. 1974 102 p refs 5 Vol.
(Contract DOT-FA73WA-3300)
(AD-A012373/7; LR-26075-Vol-3; FAA-EQ-73-6-3) Avail: NTIS HC $5.25 CSCL 01/3

A description is presented of the logic and the procedures for the noise definition calculations which were developed into a digital-computer program. Sufficient detail is included to permit judgements to be made regarding the applicability of the program to any particular noise study. For Volume 1, see N75-33046. Author

N75-33049# Lockheed Aircraft Corp., Burbank, Calif.
COMMERCIAL AIRCRAFT NOISE DEFINITION; L-1011 TRISTAR. VOLUME 4: PROGRAM DESIGN SPECIFICATION Final Report, Jun. 1973 - Sep. 1974
Nathan Shapiro Sep. 1974 127 p 5 Vol.
(Contract DOT-FA73WA-3300)
(AD-A012374/5; LR-26075-Vol-4; FAA-EQ-73-6-4) Avail: NTIS HC $5.75 CSCL 01/3

The input formats and the output options for the noise definition and noise propagation computer programs are given. Test cases are included along with descriptions of plot subroutines and utility subroutines. For Volume 1, see N75-33046. M.J.S.

N75-33050# Lockheed Aircraft Corp., Burbank, Calif.
COMMERCIAL AIRCRAFT NOISE DEFINITION; L-1011 TRISTAR. VOLUME 5: COMPUTER PROGRAMMER'S MANUAL Final Report, Jun. 1973 - Sep. 1974
Nathan Shapiro Sep. 1974 369 p 5 Vol.
(Contract DOT-FA73WA-3300)
(AD-A012375/2; LR-26075-Vol-5; FAA-EQ-73-6-5) Avail: NTIS HC $10.00 CSCL 01/3

A general description of the noise definition and noise propagation computer programs is presented along with description of subprograms and a listing of programs. For Volume 1, see N75-33046. M.J.S.

N75-33051*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL INVESTIGATION OF A MACH 6 FIXED-GEOMETRY INLET FEATURING A SWEPT EXTERNAL-INTERNAL COMPRESSION FLOW FIELD
Marvin G. Torrence Washington Oct. 1975 63 p refs
(NASA-TN-D-7998; L-10046) Avail: NTIS HC $4.25 CSCL 21A

An investigation of a fixed-geometry, swept external-internal compression inlet was conducted at a Mach number of 6.0 and a test-section Reynolds number of 1.55 x 10 to the 7th power per meter. The test conditions was constant for all runs with stagnation pressure and temperature at 20 atmospheres and 500 K, respectively. Tests were made at angles of attack of -5 deg, 0 deg, 3 deg, and 5 deg. Measurements consisted of pitot- and static-pressure surveys in inlet throat, wall static pressures, and surface temperatures. Boundary-layer bleed was provided on the centerbody and on the cowl internal surface. The inlet performance was consistently high over the range of the angle of attack tested, with an overall average total pressure recovery of 78 percent and corresponding adiabatic kinetic-energy efficiency of 99 percent. The inlet throat flow distribution was uniform and the Mach number and pressure level were of the correct magnitude for efficient combustor design. The utilization of a swept compression field to meet the starting requirements of a fixed-geometry inlet produced neither flow instability nor a tendency to unstart. Author

N75-33052*# Scientific Translation Service, Santa Barbara, Calif.
THERMODYNAMIC INVESTIGATION OF GAS TURBINES WITH CONTROLLED CONSTANT VOLUME COMBUSTION
H. May, H. Prehn, and M. Schaffrath Washington NASA Oct. 1975 29 p refs Transl. into ENGLISH from Brenns-Waerme-Kraft (Duesseldorf), v. 21, no. 12, Dec. 1969 p 620-627
(Contract NASw-2791)
(NASA-TT-F-16618) Avail: NTIS HC $3.75 CSCL 21E

A process is described which is based on controlled combustion at constant volume. The efficiency and specific output are calculated, as are the pressures, temperature, and compositions of the gas mixture obtained in different parts of the installation. Comparisons were made with values found for constant pressure combustion. Assuming the permissible blade temperature is the same for both processes, the achievable efficiencies and specific power outputs are compared as a function of the compression ratio. The effect of different turbine efficiencies is considered. Author

N75-33053*# Kanner (Leo) Associates, Redwood City, Calif.
OPTIMUM DESIGN OF A BYPASS ENGINE WITH FLOW MIXING
A. Hartmann Washington NASA Oct. 1975 26 p refs Transl. into ENGLISH from Wiss. Ges. fuer Luft- und Raumfahrt and Deut. Ges. fuer Raketentechnik und Raumfahrtforschung, Jahrestagung (Berlin), 14-18 Sept. 1964 p 353-361
(Contract NASw-2790)
(NASA-TT-F-16615) Avail: NTIS HC $3.75 CSCL 21E

The possible advantages of mixing exhaust and bypass flows in a bypass engine are explained. The influences of the pressure ratio of the primary flow, the gas temperature in front of the turbine, the bypass ratio and nacelle drag were calculated on a digital computer and the results are explained. Thrust and efficiency of the bypass engine with mixing are discussed together with the corresponding values of a bypass engine without mixing and the pure turbojet engine. Also considered is the influence of the limited mixing chamber cross section and of partial mixing. Author

N75-33054*# United Technologies Research Center, East Hartford, Conn.
PREDICTION OF EXTERNALLY BLOWN FLAP NOISE AND TURBOMACHINERY STRUT NOISE
Martin R. Fink Aug. 1975 142 p refs
(Contract NAS3-17863)
(NASA-CR-134883) Avail: NTIS HC $5.75 CSCL 20A

Methods were developed for predicting externally blown flap (EBF) noise and turbomachinery strut noise. Noise radiated by under-the-wing and upper-surface-blowing EBF configurations is calculated as a sum of lift dipole noise, trailing edge noise, and jet quadrupole noise. Resulting predictions of amplitudes and spectra generally were in good agreement with data from small-scale models. These data cover a range of exhaust velocity, flap deflection, exhaust nozzle position, exhaust nozzle shape, and ratio of exhaust nozzle diameter to wing chord. A semi-empirical method for predicting dipole noise radiation from a strut with incident turbulence was in good agreement with data. Leading-edge regions made of perforated plate backed by a bulk acoustic absorber achieved up to 7 db reduction of strut noise caused by incident turbulence at high frequencies. Radial turbulence in a turbofan exit duct was found to have a relatively high level associated with the mean velocity defect in the rotor

blade wakes. Use of these turbulence spectra and a dipole noise radiation equation gave general prediction of measured aft-radiated sound power caused by a splitter ring in a full-scale fan exit duct. Author

N75-33055*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT OF CIRCUMFERENTIAL SEAL FOR HELICOPTER TRANSMISSIONS: RESULTS OF BENCH AND FLIGHT TESTS
Thomas N. Strom and Lawrence P. Ludwig Sep. 1975 20 p refs
(NASA-TM-X-71806; E-8496) Avail: NTIS HC $3.25 CSCL 11A

A modified circumferential segmented ring seal was designed for direct replacement of a helicopter transmission elastomeric lip seal operating on a shaft diameter of 13.91 centimeters (5.481 in.) at sliding velocities to 52.48 m/sec (10 330 ft/min). The modifications involved the garter spring tension, shaft roundness, seal housing flatness, and pumping grooves to inhibit leakage. Operation of the seals in bench tests under simulated helicopter transmission conditions revealed that the seal leakage rate was within acceptable limits and that the wear rate was negilible. The low leakage and wear rates were confirmed in flight tests of 600 and 175 hours (sliding speed, 48.11 m/sec (9470 ft/min)). An additional 200 hours of air worthiness qualification testing (aircraft tie down) demonstrated that the seal can operate at the advanced sliding conditions of 52.48 m/sec (10 330 ft/min). Author

N75-33056*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INSTALLATION AND AIRSPEED EFFECTS ON JET SHOCK-ASSOCIATED NOISE
U. VonGlahn and J. Goodykoontz 1975 26 p refs Presented at 90th meeting of the Acoustical Society of America, San Francisco, 4-7 Nov. 1975
(NASA-TM-X-71792; E-8469) Avail: NTIS HC $3.75 CSCL 20A

Experimental acoustic data are presented to illustrate, at model scale, the effect of varying the nozzle-wing installation on shock-associated noise, statically and with airspeed. The variation in installations included nozzle only, nozzle under-the-wing (with and without flaps deflected), and nozzle over-the-wing (unattached flow). The nozzles used were a conical and a 6-tube mixer nozzle with a cold-flow nozzle pressure ratio of 2.1. A 33-cm diameter free jet was used to simulate airspeed. With the nozzle only, shock wave noise dominated the spectra in the forward quadrant, while jet mixing noise dominated in the rearward quadrant. Similar trends were observed when a wing (flaps retracted) was included. Shock noise was attenuated with an over-the-wing configuration and increased with an under-the-wing configuration (due to reflection from the wing surface). With increasing flap deflection (under-the-wing configuration), the jet-flap interaction noise exceeded the shock noise and became dominant in both quadrants. The free jet results showed that airspeed had no effect on shock noise. The free jet noise data were corrected for convective amplification to approximate flight and comparisons between the various configurations are made. Author

N75-33057*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLD-AIR INVESTIGATION OF A 3 1/2-STAGE FAN-DRIVE TURBINE WITH A STAGE LOADING FACTOR OF 4 DESIGNED FOR AN INTEGRAL LIFT ENGINE. 1: TURBINE DESIGN AND PERFORMANCE OF FIRST STAGE
Warren J. Whitney, Harold J. Schum, and Frank P. Behning Washington Oct. 1975 39 p refs
(NASA-TM-X-3289; E-8354) Avail: NTIS HC $3.75 CSCL 21E

The design of the 3 1/2-stage turbine is described, and the cold-air performance of the first stage, modified for axial inlet conditions, is presented. The performance of the modified single-stage turbine and of two comtemporary high-stage-loading-factor turbines is compared with that estimated with a reference prediction method. Author

N75-33058# Environmental Health Lab., McClellan AFB, Calif.
NOISE SURVEY FOR ADDITION OF T-37 AIRCRAFT AT MATHER AFB, CALIFORNIA Final Report
Ronald D. Burnett, Marlin L. Sweigart, and Harry P. Guy Jun. 1974 19 p
(EHL Proj. M-NBF-348)
(AD-A010037; EHL-M-74M-9) Avail: NTIS CSCL 20/1

Noise levels generated by T-37 aircraft were measured at Mather AFB CA while simulating various ground operations and during a flyover. These data were collected to assist in the evaluation of the impact of a proposed T-37 mission on base activities. Noise was recorded inside and outside selected buildings on base which were thought to be affected by these operations. Maximum levels encountered at each building are presented. Measured noise levels indicate little or no impact on base activities from noise generated during operation of T-37 aircraft. Where appropriate, recommendations for minimizing noise and suggestions for additional evaluations are made. GRA

N75-33059# Informatics, Inc., Rockville, Md.
INFORMATION OF FAA CERTIFICATION OF AIRCRAFT
Carl Modig Jan. 1975 84 p refs
(Contract EPA-68-01-3115)
(PB-242583/3; EPA-550/9-75-022) Avail: NTIS HC $4.75 CSCL 01C

An overview is presented of FAA aircraft type certification regulations and the regulatory process through which aviation noise regulations are or could be implemented. Special reference is made to the regulatory process most relevent to transport category and/or turbine powered aircraft. The various types of certificates are covered. Tabular data for various types and models certificated since 1969 are presented as well as types or models complying with the noise limits in Appendix C of FAR 36. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N75-33060 Virginia Univ., Charlottesville.
APPLICATION OF ACTIVE CONTROLS TECHNOLOGY TO AIRCRAFT RIDE SOOTHING SYSTEMS Ph.D. Thesis
Maris Lapins 1975 206 p
Avail: Univ. Microfilms Order No. 75-22169

A critical review of past efforts in the design and testing of ride smoothing and gust alleviation systems is presented. Design tradeoffs involving sensor types, choice of feedback loops, human comfort and aircraft handling-qualities criteria are discussed. Synthesis of a system designed to employ direct-lift and side-force producing surfaces is reported. Two STOL-class aircraft and an executive transport are considered. Theoretically-predicted system performance is compared with hybrid simulation and flight test data. Pilot opinion rating, pilot workload, and passenger comfort rating data for the basic and augmented aircraft are included. Dissert. Abstr.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N75-33061*# Scientific Translation Service, Santa Barbara, Calif.
BALLISTIC RANGES AND THEIR APPLICATIONS IN EXPERIMENTAL RESEARCH
N. A. Zlatin and G. I. Mishin Washington NASA Oct. 1975 392 p refs Transl. into ENGLISH of the book "Ballisticheskiye

Ustanovki i ikh Primeneniye v Eksperimentalnykh Issledovaniyakh" Nauka Press, Moscow, 1974 p 1-344
(Contract NASw-2791)
(NASA-TT-F-16501) Avail: NTIS HC $10.25 CSCL 14B

A systematic presentation of the theory and practice of high speed ballistic ranges, survey of the modern methods used to study high speed phenomena, and examination of the results of studies of the processes taking place during high speed motion of bodies of various shapes in gaseous and solid media, were given. The following subjects were covered: high velocity launchers, fundamentals of light-gas launcher design, measurement apparatus and techniques, dynamics of solid media, and aeroballistic investigation methods. This book is intended for scientists, engineers, physicists, and technical personnel of the scientific research institutes studying the aerodynamics, gasdynamics, and mechanics of continua, and also for graduate students and upper level students in the physical and mechanical sciences. Author

N75-33062*# Contraves Goerz Corp., Pittsburgh, Pa.
A THREE-AXIS FLIGHT SIMULATOR Final Report
Michael G. Mason 1975 48 p
(Contract NAS8-31018)
(NASA-CR-143975; TR-3547) Avail: NTIS HC $3.75 CSCL 14B

A simulator is described, which was designed for testing and evaluating inertial measuring units, and flight platforms. Mechanical and electrical specifications for the outer, middle, and inner axis are presented. Test results are included. F.O.S.

N75-33063*# New Technology, Inc., Huntsville, Ala.
DATA ACQUISITION AND ELECTROMAGNETIC DAMPER SYSTEMS FOR SPACE SHUTTLE GROUND WIND LOADS TEST Final Report
15 Sep. 1975 75 p refs
(Contract NAS8-30814)
(NASA-CR-143989; T1114F) Avail: NTIS HC $4.25 CSCL 14B

Analyses were made of data acquisition, damper and dynamic calibration requirements for conducting space shuttle ground wind load tests in NASA/LaRC's 16-Foot Transonic Dynamics Tunnel. These requirements were compared with capabilities of existing systems which were used by MSFC in previous tests of similar nature. Required system and component improvement methods were investigated. A number of system modifications were accomplished. Other, more routine changes are appropriately left for implementation in the future when the overall program assumes a definitive configuration. Author

N75-33064# Waterloo Univ. (Ontario). Transport Group.
A COMPUTERIZED DESIGN METHOD FOR PRELIMINARY AIRPORT TERMINAL SPACE PLANNING
John P. Braaksma Oct. 1973 281 p refs Sponsored by National Research Council and Canadian Transport Agency
Avail: NTIS HC $8.75

A design methodology, based on the heuristic modelling technique was developed; it was computerized for automated design. The methodology is composed of three major algorithms; the facility sizing algorithm, the load assignment algorithm, and the facility layout algorithm. The facility sizing algorithm determines the minimum amount of real space which must be supplied (the corollary is the maximum utilization of that space). The load assignment algorithm assigns loads (flights or parts of flights) to the facilities in such a way that the transport cost, expressed as the sum of the products of passenger flow times distance, is at a minimum. The facility layout algorithm locates the facilities relative to each other in such a manner that the transport cost is also at a minimum. The process returns to the load assignment algorithm for a new assignment of loads to see if the transport cost can be reduced. If so a, layout is produced and again checked for a possible cost reduction. This iteration continues until an optimum design has been obtained. Author

N75-33065# National Bureau of Standards, Washington, D.C.
VALIDATION OF MAXIMUM AIRPORT THROUGHPUT LEVELS ESTIMATED BY THE DELCAP SIMULATION MODEL Final Report
Judith F. Gilsinn Jan. 1975 73 p
(AD-A011485/0; NBSIR-75-638; FAA-RD-75-66) Avail: NTIS HC $4.25

Exercises are documented of the DELCAP airport terminal area simulation model performed to validate the maximum throughput calculations of that model. DELCAP was run for five different runway configurations, with three or four appropriate operating policies chosen for each, and for three different mixes of aircraft types. Throughput estimates from DELCAP were found to be in general agreement with current values provided by the FAA. One specific instance of greater discrepancy is identified, and a remedy for it is proposed. Changes made in DELCAP since its original documentation in 1971 are described in an appendix. Author

N75-33066# Air Force Weapons Lab., Kirtland AFB, N.Mex. Civil Engineering Research Div.
EVALUATION OF INERTIAL AND LASER PROFILOMETER SYSTEMS Final Report, 16 Nov. 1973 - 31 Dec. 1974
Neal P. Baum and Trudy Ann Stough Apr. 1975 50 p
(Contract DOT-FA73WAI-361)
(AD-A012497/4; AFWL-TR-74-289; FAA-RD-74-188) Avail: NTIS HC $3.75 CSCL 01/5

Two profiling systems, a laser system and an inertial system, were developed for use in runway roughness studies, and are evaluated. The laser system produces an absolute profile that is accurate to 0.085 inches in 1000 feet. Using this system, 3 technicians can survey a 10,000-foot runway in 1-1/2 to 2 hours. The inertial system provides data usable only between the nominal wavelengths of 3 and 400 feet and is accurate to .014 inches in 400 feet. Two technicians using this system can survey a 10,000-foot runway in about 10 minutes. Profile data from both systems are suitable for use with a computer program for predicting the dynamic response of aircraft to runway roughness. Because the inertial profile data are wavelength limited, they are not suitable for use in the direct development of a profile capable of being used as a reference to smooth the runway. Author

N75-33067# Howard, Needles, Tammen and Bergendoff, Alexandria, Va.
FIELD SURVEY AND ANALYSIS OF AIRCRAFT DISTRIBUTION ON AIRPORT PAVEMENTS Final Report
Victor A. HoSang Feb. 1975 280 p Sponsored in part by Army
(Contract DOT-FA71WAI-218)
(AD-A011488/4; FAA-RD-74-36) Avail: NTIS HC $8.75 CSCL 01/5

Data for the current, mostly-commonly-used air carrier aircraft were collected and analyzed. The data collected at nine major civil airports include observations of lateral wheel-path distributions on runways, runway exists, and taxiways; operating ground speeds on runways and taxiways; and the general areas of aircraft touchdown and rotation on runways. Statistical analysis on runways and taxiways are more accurately represented by theoretical normal distribution functions, compared with the uniform distribution assumed in the current pass-to-coverage relationship. The mean and standard deviations of the observed distributions were calculated and are presented by aircraft type. These mean and standard deviation values may be used as the basis for selecting representative normal distribution functions for use in developing more realistic p/c relationships, for either individual or groupings of aircraft types. Author

N75-33068# Georgia Inst. of Tech., Atlanta.
FAA LIGHTNING PROTECTION STUDY: LIGHTNING PROTECTION REQUIREMENTS FOR MARK 3 INSTRUMENT LANDING SYSTEM (CATEGORY 3) Final Report, 1 Jan. 1974 - 1 Feb. 1975
Gene K. Huddleston and Gary G. Bush Feb. 1975 194 p refs
(Contract DOT-FA72WAI-356)
(AD-A011489/2; FAA-RD-75-73) Avail: NTIS HC $7.00 CSCL 17/7

The withstand capabilities and protection requirements for solid state circuits of the Mark III instrument landing system susceptible to lightning-induced transients on buried control cables are presented. Susceptible circuits and components were

identified from the wiring diagrams as transistors, diodes, relay contacts, and electrolytic capacitors. Withstand capabilities of each circuit were determined analytically and experimentally using manufacturer's data and a 1000-volt, 10 x 1000 microns sec test waveform. Avalanche diode surge protectors and series resistance are recommended to protect susceptible circuits from lightning-induced transients on buried control cable conductors connected to the circuits. Author

N75-33069# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.

HIGH POWER ARC HEATERS AND EXPANSION NOZZLES FOR HIGH ENTHALPY FLOW INVESTIGATIONS

Martin Fiebig, Knud Kindler, and Demetrius G. Papanikas 27 Feb. 1975 74 p refs In GERMAN; ENGLISH summary

(DLR-Mitt-75-06) Avail: NTIS HC $4.25; DFVLR, Porz, West Ger. DM 28.10

A vortex stabilized DC arc and hypersonic nozzle were developed and tested. The are heater was designed as an energy supply to heat air at pressures up to 10 to the 7th power N/sq m enthalpies up to 20 MJ/kg. Compactness, versatility and easy exchange of parts are the main design principles. By slight variations of the basic arc, stable burning was achieved for mass flows between 3 and 70 g/sec., and enthalpies above 20 MJ/kg as well as pressures of 2 million N/sq m were measured. The power input and maximum pressure were limited to 0.7 MW and 2.2 million N/sq m by the dc power and air supply. The conical nozzles were designed for pressures of 10 to the 7th power N/sq m and stream power of 1 MW, with half-angles of 12 to 15 deg, throat diameters between 2 and 14 mm and exit diameters between 100 and 600 mm.

Author (ESA)

N75-33070# Institut Franco-Allemand de Recherches, St. Louis (France).

CALCULATION OF AN EXPLOSIVE CHARGE DETONATION IN A TUNNEL [CALCUL DE LA DETONATION D'UNE CHARGE EXPLOSIVE DANS UN TUNNEL]

L. Bobin, F. Wecken, and B. Masure 25 Nov. 1974 26 p refs In FRENCH Presented at the colloq. "Les Methodes d'Etudes et Simulation des Chocs", Lyon, Oct. 1974, and the 4th Intern. Symp. on Mil. Appl. of Blast Simulation, Southend-on-Sea, Engl., 9-12 Sep. 1974

(ISL-CO-31/74) Avail: NTIS HC $3.75

A theoretical description of the pressure profile and other parameters associated with shock waves generated using explosives was presented, including the one-dimensional detonation of a moderately loaded explosive. The state of the detonation products and their isentropic evolution were obtained from the hypothesis of a weak detonation. The method of characteristics was used to compute numerically the flow behavior in the detonation chamber and the formation of the original shock wave. Study of the shock wave propagation itself was performed by the same method, taking wall effects into account. Overpressure values of 10 to 50 bars lasting for 0.1 sec were obtained and showed correct agreement between theory and experiment for blast intensity and attenuation. Author (ESA)

N75-33071# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France). Service Aerodynamique.

PERFORMANCE TESTS OF THE ADAPTATION OF THE C4 WIND TUNNEL TO TRANSONIC FLOW. 1ST AND 2ND TEST CAMPAIGNS [ESSAIS DE FONCTIONNEMENT DU DISPOSITIF D'ADAPTATION DE LA SOUFFLERIE C4 AU SOUFFLAGE EN TRANSSONIQUE. 1ERE ET 2EME CAMPAGNES D'ESSAIS]

R. Blangier 21 Mar. 1975 139 p refs In FRENCH

(Contract DTEN-74/128)

(LRBA-E-1032-PV-4/SAE) Avail: NTIS HC $5.75

Performance tests of the C4 wind tunnel's adaptation to the transonic regime are presented. The nozzle used is subsonic with permeable walls. The layout is detailed with regard to aspiration of the expanding flow, load loss grids models to be tested, pressure measurement, data acquisition and processing, and display devices. Results are presented in tabular and graphical form. ESA

N75-33072# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

AIRPORT TERMINAL DESIGN

D. Bennetts, N. Hawkins, P. D. McGinity, M. OLeary, and N. Ashford May 1975 55 p refs Sponsored by Sci. Res. Council

(TT-7506) Avail: NTIS HC $4.25

Concepts of structural design are discussed. An approach is described with two principal aims: (1) to ensure that airport terminals are both efficient and pleasant environments for all passengers, and (2) to develop a more flexible approach to the design of terminals that can accommodate daily, monthly, and seasonal peak demands and which can adapt to longer term changes in the demand for air travel. The design and model construction for a mobile lounge concept is considered. ESA

N75-33073# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

STOCHASTIC MODELLING OF AIRPORT PROCESSING

D. Bennets, N. M. Hawkins, M. OLeary, P. D. McGinity, and N. Ashford Jul. 1975 214 p refs Sponsored by Sci. Res. Council

(TT-7509) Avail: NTIS HC $7.25

The construction and validation of a mathematical airport model which can be used as a framework for the analysis of the processing activities of a regional airport in an aggregate manner was described. The model tends to be statistical because of the nature of processing at airport terminals. For design purposes, the models are tailored to fit into an interactive design process for airport terminals. Three main techniques are considered: analytical queuing theory, deterministic queuing theory, and simulation. A limited set of queuing models of airport processing, both landside and airside activities, was developed. Empirical information obtained from airport surveys was used to validate the proposed model of passenger processing.

Author (ESA)

N75-33074# Ballistic Research Labs., Aberdeen Proving Ground, Md.

THE MARRIAGE OF OPTICAL, TRACER AND SURFACE INDICATOR TECHNIQUES IN FLOW VISUALIZATION Final Report

Raymond Sedney, Clarence W. Kitchens, Jr., and Clarence C. Bush Feb. 1975 57 p refs

(DA Proj. 1T0-61101-A-91A)

(AD-A007729; BRL-1763) Avail: NTIS CSCL 14/2

The concept of uniting two or more flow visualization techniques is emphasized. Although this can be done, for a number of flow situations, using instrumentation and methods that have been available for many years, the use of modern technology and intruments makes such unions more easily realized. Some examples of this concept are discussed. Results are presented for a combined optical- shadowgraph and schlieren surface indicator oil flow technique, a versatile vapor screen technique using a CW laser and a reversible dye technique. Whether used alone or united to the others, the latter is especially valuable for use in a continuous wind tunnel since the surface flow patterns are erasable. GRA

N75-33075# Army Construction Engineering Research Lab., Champaign, Ill. Engineering Research Lab.

THE STATUS OF DEVELOPMENT OF A MAINTENANCE MANAGEMENT SYSTEM FOR AIRFIELD PAVEMENTS Final Report, Jul. 1971 - Jun. 1974

P. F. McManus May 1975 76 p refs

(Contract F29601-71-X-0002)

(AD-A011589; AFWL-TR-74-15423) Avail: NTIS

The objective of the project is to develop methodology for determining cost-effective plans for preventive maintenance of airfield pavements so that functional requirements are met with a minimum of major repair and reconstruction effort. The approach for meeting these objectives is to create a computerized Maintenance Management System which will predict maintenance requirements, analyze alternative schedules of maintenance activities and determine cost-effective schedules, monitor actual pavement performance, and provide reports on the performance and cost of pavement facilities to all levels of command. At present, two computer codes are available, PREDICT and PAVER,

which have been developed for this project and concurrent projects sponsored by the U.S. Army Corps of Engineers. These programs are recommended for use in test implementations at Air Force bases. GRA

N75-33076# Systems Research Labs., Inc., Dayton, Ohio.
VISUAL SIMULATION VIDEO PROCESSING TECHNIQUES Final Report, Feb. 1973 - 10 Jun. 1974
Kenneth M. Irish and James H. Orszulak Dec. 1974 175 p refs
(Contract F33615-73-C-4057; AF Proj. 6114)
(AD-A009640; AFHRL-TR-74-76) Avail: NTIS CSCL 05/9

This report describes a two-phase program to further the development of visual simulation video processing techniques as applied to a wide angle optical probe/TV camera. Phase 1 included the study of applicable wide-angle display techniques, study of additional processing of the probe's video signal for proper mating to a display, study of color visual requirements, and a review of state-of-the-art separation techniques for TV cameras. Phase 2 dealt with the construction of a video matrix generator to provide the necessary electronic processing to mate the optical probe/TV camera system to applicable wide angle displays. GRA

N75-33077# New Mexico Univ., Albuquerque. Eric H Wang Civil Engineering Research Facility.
INFLUENCE OF WATER DEPTH ON TRACTION CHARACTERISTICS OF ASPHALT CONCRETE PAVEMENTS Final Report, Jan. - Nov. 1973
George E. Triandafilidis and Emil R. Hargett Nov. 1974 71 p
(Contract F29601-72-C-0024; AF Proj. 683M)
(AD-A001599; AFWL-TR-74-152) Avail: NTIS CSCL 01/5

An investigation was conducted on taxiway two at the Albuquerque International Airport, Kirtland Air Force Base to study the influence of various amounts of water (0.05, 0.10, 0.20, and 0.30 in.) on the traction characteristics of an asphalt concrete pavement. Both the Mu-Meter and the diagonally braked vehicle (DBV) were used in this investigation. Correlations between coefficient of friction and time after wetting parametricized with respect to water depth and correlations between stopping distance ratio (SDR) and time after wetting were determined. GRA

N75-33078# Cornell Univ., Ithaca, N.Y.
IMPULSE NOISE GENERATORS AND TESTING OF MODEMS
Yrjo Neuvo and Walter H. Yu Mar. 1975 118 p
(Contract F30602-72-C-0497)
(AD-A010003; RADC-TR-75-68) Avail: NTIS CSCL 14/2

The report presents results on the hardware implementations and testing of the impulse noise generators described in an earlier RADC technical report. The Prototype impulse noise generator consists of two separate units. Samples from the lognormal distribution are generated in one unit. Since the lognormal amplitude distribution is a frequently used model for impulse noise in wireline, this unit can be used directly to simulate the wireline impulse noise. The second unit generates the pseudorandom background noise and burst timing signals and can be used to simulate various burst impulse noise present in wideband communication systems. The noise generators are all implemented using standard TTL integrated circuits. Results are also presented on using the hardware impulse noise generators to test a number of modems operating at the 4800 bps rate. Measured results show the effect of burst impulse noise with different parameters on the bit-error-rate (BER) and on the throughput of the modems tested. GRA

N75-33079# Air Force Weapons Lab., Kirtland AFB, N.Mex.
POROUS FRICTION SURFACES FOR AIRFIELD PAVEMENTS Final Report, Mar. 1973 - Jun. 1974
Hisao Tomita and J. B. Forest May 1975 157 p refs Prepared in cooperation with Naval Civil Engineering Lab.
(AF Proj. 683M)
(AD-A010430; AFWL-TR-74-177) Avail: NTIS CSCL 01/5

When vehicles operate at high speeds over wet pavements there is a tendency for the water to impede intimate contact between the tire and pavement. The resulting loss of friction can result in loss of control of the vehicle, and is referred to as hydroplaning. A porous surfacing over the pavement permits water to drain laterally and vertically away from the wheel path, resulting in a much reduced hydroplaning potential. The design, construction, and performance of porous asphalt surfacings is discussed with regard to the use of these surfacings on airfield pavements. These surfacings, commonly referred to as Porous Friction Surface (PFS), are open graded asphaltic concretes that permit water to drain through them onto an underlying impervious layer and thence laterally to the pavement edge. GRA

N75-33080# California Univ., Berkeley. Earthquake Engineering Research Center.
EARTHQUAKE SIMULATOR STUDY OF A REINFORCED CONCRETE FRAME
P. Hidalgo and R. W. Clough Dec. 1974 292 p refs
(Grant NSF GI-36387)
(PB-241944/8; EERC-74-13) Avail: NTIS HC $8.75 CSCL 13M

The first test is presented of a reinforced concrete structure conducted at the Earthquake Simulator Laboratory located at the University of California, Berkeley. A two story, one bay structure, representing the behavior of a typical small apartment or office building, was designed to meet the ductile concrete requirements of the 1970 Uniform Building Code and the ACI 318-71 Code. Using the 20 ft. square shaking table, it was subjected to a series of simulated earthquake ground motions with intensity large enough to cause significant inelastic deformations and change in the properties of the structure; the maximum base acceleration achieved was 0.46 g. The test structure was then repaired by injecting epoxy into the cracks and tested again with ground motions of equal or larger intensity than before. The structure was finally tested until failure using a static, horizontal load applied at the top floor. GRA

N75-33081# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.
DESIGN, CONSTRUCTION, AND EVALUATION OF A SMALL-SCALE FIRE RESEARCH WIND TUNNEL
James V. Golden, John R. Lloyd, and Jerome L. Novotny Nov. 1974 96 p refs
(Grant NSF ATA73-07749-A01)
(PB-242236/8; TR-37191-74-5; NSF/RA/E-74-067) Avail: NTIS HC $4.75 CSCL 13L

A small scale fire research facility was designed and constructed to provide apparatus with which data could be obtained for the proposal and evaluation of basic models of radiation, turbulence, and combustion processes in fire situations. The facility was designed to be as versatile as possible in order to permit the geometrical configuration to be modified with a minimum of difficulty. The basic apparatus was a wind tunnel constructed such that its aspect ratios could be varied. Velocity and temperature probes were constructed to provide the appropriate profiles at various locations in the tunnel test section. GRA

N75-33082# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.
DESIGN, CONSTRUCTION AND EVALUATION OF SMALL SCALE FIRE AND SMOKE SPREAD FACILITY AT THE UNIVERSITY OF NOTRE DAME
John R. Lloyd, James V. Golden, and Paul K. Schroeder Feb. 1974 35 p refs
(Grant NSF ATA73-07748-A01)
(PB-242235/0; TR-37191-74-2; NSF/RA/E-74-066) Avail: NTIS HC $3.75 CSCL 13L

A small scale experimental facility to study fire and smoke spread models is used to study and propose valid analytical models of radiation, combustion and turbulence in corridor-type flows. The apparatus is basically a small wind tunnel capable of bulk fluid velocities of from 0-58 ft/sec. Gaseous fuel is injected through a porous plate which functions as part of wall (top, bottom, or side). It is variable in streamwise width and can be sized to approximate a line source of fuel. Probes are constructed to obtain velocity, temperature and species concentration profiles and the walls are instrumented to obtain axial wall temperature distributions. GRA

N75-33083*# Multidisciplinary Associates, San Francisco, Calif.
SAN FRANCISCO FLOATING STOLPORT STUDY
28 Feb. 1974 92 p Prepared in cooperation with NORCALSTOL, San Francisco
(NASA-CR-119162; AD-A009178) Avail: NTIS HC $4.75 CSCL 01/5

The report describes a cooperative transaction concerning the study of the feasibility of a floating STOLport on the San Francisco Bay. GRA

N75-33084# Air Force Civil Engineering Center, Tyndall AFB, Fla.
METHODS FOR REDUCING THE SLIPPERINESS OF PAINTED RUNWAY MARKINGS Interim Report, 1 Jun. 1974 - 1 Apr. 1975
Thomas J. Black, III May 1975 26 p refs
(AD-A010723; AFCEC-TR-75-8) Avail: NTIS CSCL 01/5

The project investigated four test sections on asphaltic concrete (AC) and eight test sections on Portland cement concrete (PCC) for methods of reducing runway paint marking slipperiness. Periodic paint removal enables AC surfaces to maintain adequate skid resistance. Mixing small, angular aggregate with the glass spheres for the standard airfield marking maintains skid resistance at least equal to that of the adjacent unmarked pavement. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

N75-33085*+ Universities Space Research Association, Charlottesville, Va.
BIBLIOGRAPHY OF THE SPACE PROCESSING PROGRAM. VOLUME 1: A COMPILATION. THROUGH JUNE 1974, PARTS 1 AND 2
Michael B. Shoultz and Eugene W. McClurken, Jr. Oct. 1975 653 p refs
(Contract NAS8-31349; Grant NGR-47-102-003)
(NASA-CR-143985) Avail: NTIS HC $15.25 CSCL 22A

A compilation of NASA research efforts in the area of space environmental effects on materials and processes is presented. Topics considered are: (1) fluid mechanics and heat transfer; (2) crystal growth and containerless melts; (3) acoustics; (4) glass and ceramics; (5) electrophoresis; (6) welding; and (7) exobiology. J.R.T.

N75-33086*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
NINTH AEROSPACE MECHANISMS SYMPOSIUM
1974 389 p refs Symp. held at Cocoa Beach, Fla., 17-18 Oct. 1974
(NASA-TM-X-72882) Avail: NTIS HC $10.25 CSCL 22A

Papers are presented dealing with performance and development of various spacecraft components, mechanical devices, and subsystems. Topics discussed include: manipulator arms, the Skylab Parasol, cooling system performance, extendable boom, magnetically suspended reaction wheels, the Skylab Trash Airlock, magnetometers, actuators, life support systems, and technology transfer. For individual titles, see N75-33087 through N75-33112.

N75-33087* General Dynamics/Convair, San Diego, Calif.
FORWARD BEARING REACTOR MECHANISM FOR TITAN 3-E/CENTAUR D-1T SPACE LAUNCH VEHICLE **c15**
Richard A. Jones *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 19 p (For availability see N75-33086 24-12)
CSCL 22D

A load sharing system between the Titan/Centaur launch vehicle and its aerodynamic shroud is described. The system provides a precise spring constant and is capable of being inactivated during flight. Design requirements, design details, and the test program are discussed. Author

N75-33088* Martin Marietta Corp., Denver, Colo.
A MANIPULATOR ARM FOR ZERO-g SIMULATIONS **c54**
Shepard B. Brodie, Christopher Grant, and Janos J. Lazar *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 12 p (For availability see N75-33086 24-12)
CSCL 05H

A 12-ft counterbalanced Slave Manipulator Arm (SMA) is described. The SMA is to be used for resolving the questions of operational applications, capabilities, and limitations for such remote manned systems as the Payload Deployment and Retrieval Mechanism (PDRM) for the shuttle, the Free-Flying Teleoperator System, the Advanced Space Tug, and Planetary Rovers. As a developmental tool for the shuttle manipulator system, the SMA represents an approximate one-quarter scale working model for simulating and demonstrating payload handling, docking assistance, and satellite servicing. For the Free-Flying Teleoperator System and the Advanced Tug, the SMA provides a near full-scale developmental tool for satellite servicing, docking, and deployment/retrieval procedures, techniques, and support equipment requirements. For the Planetary Rovers, it provides an oversize developmental tool for sample handling and soil mechanics investigations. Author

N75-33089* Lockheed Missiles and Space Co., Sunnyvale, Calif.
STRUCTURAL EVALUATION OF DEPLOYABLE AERODYNAMIC SPIKE BOOMS **c19**
B. J. Richter *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 14 p ref (For availability see N75-33086 24-12)
CSCL 14B

An extendable boom consisting of a series of telescopic cylindrical tube segments and overlapping lock joints developed for use as an aerodynamic spike mounted atop a missile is described. Candidate design concepts differing mainly in the particular overlapping lock joint designs are analytically and experimentally evaluated. Results of this evaluation are presented. Author

N75-33090* Ball Bros. Research Corp., Boulder, Colo.
AEROSPACE LUBRICATION TECHNOLOGY TRANSFER TO INDUSTRIAL APPLICATIONS **c37**
Thomas J. Loran and Bill Perrin *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 14 p (For availability see N75-33086 24-12)
CSCL 11H

Difficulties encountered in entering industrial markets with an aerospace lubrication and coating technology are discussed along with the technical, financial, and managerial solutions that evolved. Author

N75-33091* TRW Systems Group, Redondo Beach, Calif.
A STRUT WITH INFINITELY ADJUSTABLE THERMAL EXPANSIVITY AND LENGTH **c37**
Paul T. Nelson *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 10 p (For availability see N75-33086 24-12)
CSCL 20K

A tubular strut with an integral mechanism for adjusting its thermal expansivity and length are developed to fulfill the stringent thermal stability requirements anticipated for the metering truss in the Large Space Telescope is described. Its features may be advantageously applied to a general variety of structures and precision mechanisms where dimensional control of component elements in a dynamic thermal environment is required. Detail design, fabrication, and test of a developmental strut are discussed. Author

N75-33092* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IN-FLIGHT FRICTION AND WEAR MECHANISM **c37**
E. J. Devine and H. E. Evans *In its* 9th Aerospace Mech. Symp. 1974 12 p refs (For availability see N75-33086 24-12)
CSCL 14B

A unique mechanism developed for conducting friction and wear experiments in orbit is described. The device is capable of testing twelve material samples simultaneously. Parameters considered critical include: power, weight, volume, mounting, cleanliness, and thermal designs. The device performed flawlessly in orbit over an eighteen month period and demonstrated the

usefulness of this design for future unmanned spacecraft or shuttle applications. Author

N75-33093* Fairchild Space and Electronics Co., Germantown, Md.
METAL WITH A MEMORY PROVIDES USEFUL TOOL FOR SKYLAB ASTRONAUTS c37
G. A. Smith *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 18 p (For availability see N75-33086 24-12)
CSCL 14B

Extendible booms used to convey film cassettes weighing 56.7 kg (125 lb) between the Airlock Module and the Apollo Telescope Mount are described along with the dispensing mechanism. Problems encountered with the mechanism during the test program are discussed. These problems were mainly associated with operation in cold temperature, lubrication, and the motor/gearhead assembly. Another set of problems which arose during crew training in the water tank is also discussed. Author

N75-33094* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE SKYLAB PARASOL c18
Jack A. Kinzler *In its* 9th Aerospace Mech. Symp. 1974 16 p (For availability see N75-33086 24-12)
CSCL 22B

An alternate thermal protection system for the Skylab space station cluster was deemed necessary shortly after launch when severe damage occurred to the orbital workshop as it passed through the period of maximum dynamic pressure. Data indicated that the combination micrometeoroid and thermal shield on the sun-facing side of the vehicle had been destroyed. The simultaneous design, fabrication, and test of the Skylab Parasol System which was completed in 6 days of around-the-clock effort is described. The Skylab Parasol design was selected as the primary sunshade device based on simplicity of design, ability to fabricate quickly, and early demonstration of a working prototype which featured semiautomatic deployment from within the workshop under shirt-sleeve environment conditions. Author

N75-33095* McDonnell-Douglas Astronautics Co., St. Louis, Mo.
THE PERFORMANCE OF COMPONENTS IN THE SKYLAB REFRIGERATION SYSTEM c54
Charles E. Daniher, Jr. *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 18 p refs (For availability see N75-33086 24-12)
(Contract NAS9-6555)
CSCL 06K

The on-orbit performance of the Skylab refrigeration system components is presented. Flight anomalies are analyzed and performance of the newly developed components is described. Nine months of orbit data proved the practicality of the leak-free coolant system design. Flight-proven application of a thermal capacitor and development test results of the first all-mechanical, low-temperature mixing valve represent a significant advance in single-phase, low-temperature coolant loop design. System flight data suggest that additional instrumentation and fluid filters could have prevented system orbit performance anomalies. Author

N75-33096* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
REFURBISHMENT OF THE CRYOGENIC COOLERS FOR THE SKYLAB EARTH RESOURCES EXPERIMENT PACKAGE c19
Jerry C. Smithson and Norman C. Luksa *In its* 9th Aerospace Mech. Symp. 1974 17 p ref (For availability see N75-33086 24-12)
CSCL 14B

Skylab Earth Resources Experiment Package (EREP) experiments, S191 and S192, required a cold temperature reference for operation of a spectrometer. This cold temperature reference was provided by a subminiature Stirling cycle cooler. However, the failure of the cooler to pass the qualification test made it necessary for additional cooler development, refurbishment, and qualification. A description of the failures and the cause of these failures for each of the coolers is presented. The solutions to the various failure modes are discussed along with problems which arose during the refurbishment program. The rationale and results of various tests are presented. The successful completion of the cryogenic cooler refurbishment program resulted in four of these coolers being flown on Skylab. The system operation during the flight is presented. Author

N75-33097* McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SKYLAB TRASH AIRLOCK c54
Larry R. Price *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 12 p (For availability see N75-33086 24-12)
(Contract NAS9-6555)
CSCL 06K

The Skylab Trash Airlock (TAL) used throughout the Skylab mission to transfer trash materials that could support microbial growth from the pressurized cabin to the unpressurized waste tank is described. The TAL, which uses several basic mechanisms, was successfully operated daily for the 170 days of manned missions for a total of 637 cycles. Author

N75-33098* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PRECISION SIX-METER DEPLOYABLE BOOM FOR THE MARINER-VENUS-MERCURY 1973 MAGNETOMETER EXPERIMENT c37
Harry F. Burdick *In its* 9th Aerospace Mech. Symp. 1974 13 p refs (For availability see N75-33086 24-12)
CSCL 14B

A unique deployable boom developed for accurately positioning magnetometers 6 meters (19.7 feet) from a spacecraft is described. Position accuracy within + or - 1/2 deg can be maintained. Weight, mounting system, magnetic cleanliness, thermal dimensional stability, and natural frequency were critical constraints that were met. The boom was flown on Mariner 10 and deployed flawlessly. The design, development, and testing of the boom and optical alignment of the sensors are described. Design trades and problem solutions are discussed. Author

N75-33099* Chrysler Corp., Detroit, Mich. Defense Div.
DISPERSION DEVELOPMENT PROGRAM c99
D. J. Carlson, R. J. Lusardi, and W. H. Phillips *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 13 p (For availability see N75-33086 24-12)
(Contract DAAA21-72-C-0030)
CSCL 16C

The requirement for the predictable dispersion of small munitions over large areas from ground support missile systems has resulted in the development of a fin stabilized submissile and sling ejection system for the Little John warhead. The progressive development of this system is traced including a comparison of simulator, sled test, and flight test results. The results indicate that it is not only necessary but also possible to eject long slender bodies, from a missile warhead at Mach 1, in a stable, uniform and predictable manner. Author

N75-33100* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NEW CONCEPT FOR ACTUATING SPACE MECHANISMS c37
William C. Stange *In its* 9th Aerospace Mech. Symp. 1974 9 p ref (For availability see N75-33086 24-12)
CSCL 14B

A two-position (0 and 180 deg) actuating mechanism driven by two alternately-heated opposing flat NITINOL springs is proposed for rotating the low field triaxial fluxgate magnetometer experiment on the 1977 Mariner Jupiter-Saturn spacecraft to its 0 deg and 180 deg positions. The magnetic field, power requirements, weight, and volume of this device are very restrictive. The problems encountered in design and development are presented. Author

N75-33101* Santa Barbara Research Center, Goleta, Calif.
THE MECHANICAL DESIGN OF AN IMAGING PHOTOPOLARIMETER FOR THE JUPITER MISSIONS (PIONEER 10 AND 11) c19
James C. Kodak *In* NASA. Kennedy Space Center 9th Aerospace

Mech. Symp. 1974 12 p (For availability see N75-33086 24-12)
(Contract NAS2-5605)
CSCL 14B

The mechanical design and fabrication are discussed of the imaging photopolarimeter (IPP), a multifunction space-qualified instrument used on the Jupiter Pioneer missions. The extreme environmental requirements for the structural design, optical system, and mechanisms are described with detailed discussion of some of the design and fabrication problems encountered.
Author

N75-33102* Sperry Flight Systems, Phoenix, Ariz.
MAGNETICALLY SUSPENDED REACTION WHEELS c18
Ajit V. Sabnis, George L. Stocking, and Joe B. Dendy *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 28 p refs Prepared for JPL (For availability see N75-33086 24-12)
(Contract NAS7-100)
CSCL 22B

Magnetic suspensions offer several advantages over conventional bearings, arising because of the contactless nature of the load support. In application to spacecraft reaction wheels, the advantages are low drag torque, wearfree, unlubricated, vacuum-compatible operation, and unlimited life. By the provision of redundancy in the control electronics, single-point failures are eliminated. The rational for selection of a passive radial, active axial, dc magnetic suspension is presented, and the relative merits of 3-loop and single-loop magnetic suspensions are discussed. The design of a .678 N-m-sec (.5 ft-lb-sec) reaction wheel using the single loop magnetic suspension was developed; the design compares favorably with current ball bearing wheels in terms of weight and power.
Author

N75-33103* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Propulsion/Mechanical Dept.
USE OF COMPUTER MODELING TO INVESTIGATE A DYNAMIC INTERACTION PROBLEM IN THE SKYLAB TACS QUAD-VALVE PACKAGE c18
Raymond J. Hesser and Robert Gershman *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 13 p refs (For availability see N75-33086 24-12)
(Contract NAS9-6555)
CSCL 22B

A valve opening-response problem encountered during development of a control valve for the Skylab thruster attitude control system (TACS) is described. The problem involved effects of dynamic interaction among valves in the quad-redundant valve package. Also described is a detailed computer simulation of the quad-valve package which was helpful in resolving the problem.
Author

N75-33104* Rensselaer Polytechnic Inst., Troy, N.Y.
MODERN MECHANISMS MAKE MANLESS MARTIAN MISSION MOBILE: SPIN-OFF SPELLS STAIRCLIMBING SELF-SUFFICIENCY FOR EARTHBOUND HANDICAPPED c54
George N. Sandor, David R. Hassel, and Philip F. Marino *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 18 p refs (For availability see N75-33086 24-12)
(Grant NGL-33-018-091)
CSCL 05H

Concepts were developed for three wheel chairs from progressively improving designs of a proposed unmanned roving vehicle for the surface exploration of Mars; as a spin-off, a concept for a stair-climbing wheel chair was generated. The mechanisms employed in these are described. The Mars mission is envisioned using the booster rockets and aeroshell of the Viking missions.
Author

N75-33105* Lockheed Missiles and Space Co., Sunnyvale, Calif.
LOADCELL SUPPORTS FOR A DYNAMIC FORCE PLATE c39
C. W. Keller, L. M. Musil, and John L. Hagy (Shriners Hospital for Crippled Children) *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 17 p refs (For availability see N75-33086 24-12)
CSCL 20K

An apparatus was developed to accurately measure components of force along three mutually perpendicular axes, torque, and the center of pressure imposed by the foot of a subject walking over its surface. The data obtained were used to supplement high-speed motion picture and electromyographic (EMG) data for in-depth studies of normal or abnormal human gait. Significant features of the design (in particular, the mechanisms used to support the loadcell transducers) are described. Results of the development program and typical data obtained with the device are presented and discussed.
Author

N75-33106* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
DEVELOPMENT OF A BONE-FIXATION PROSTHETIC ATTACHMENT c52
Lester J. Owens *In its* 9th Aerospace Mech. Symp. 1974 13 p (For availability see N75-33086 24-12)
CSCL 06B

An artificial limb attached directly to the bone by a quick-disconnect coupling was tested in-place at a California medical rehabilitation center. Its design concept and development, made possible by multiple spinoffs of aerospace technology, are discussed.
Author

N75-33107* Rockwell International Corp., Downey, Calif.
A UNIQUE CHALLENGE: ENERGY EGRESS AND LIFE SUPPORT EQUIPMENT AT KSC c54
Henry M. Waddell, Jr. *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 19 p (For availability see N75-33086 24-12)
CSCL 06K

As a result of the investigation following the January 1967 fire, which took the lives of three astronauts, materials were developed, flight hardware was modified, and test procedures were rewritten in order to establish the framework within which a more effective rescue concept could be developed. Topics discussed include breathing units, improved life support equipment, miniresuscitators, and hazardous tasks during space shuttle launch and landing operations.
Author

N75-33108* General Dynamics Corp., San Diego, Calif. Convair Aerospace Div.
A DAMPER FOR GROUND WIND-INDUCED LAUNCH VEHICLE OSCILLATIONS c14
John G. Bodle and David S. Hackley *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 23 p (For availability see N75-33086 24-12)
CSCL 22D

Prelaunch oscillatory bending deflections of the Atlas/Centaur launch vehicle are restrained by a damper mechanism mounted on the end of a horizontal boom supported from the umbilical tower. A single vertical pin on the vehicle engages the mechanism, and the damper is connected to the vehicle until liftoff. As the attach pin rises with the vehicle, a retractable arm mechanism provides initial clearance. An explosive release mechanism allows the boom to swing clear of the vehicle like a pendulum, while a snubber mechanism decelerates the free swinging boom and damper mechanism to a safe stop.
Author

N75-33109* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
HOLDDOWN ARM RELEASE MECHANISM USED ON SATURN VEHICLES c14
J. D. Phillips and B. A. Tolson *In its* 9th Aerospace Mech. Symp. 1974 24 p (For availability see N75-33086 24-12)
CSCL 22D

A system was developed for restraining the Saturn launch vehicle until after all checks and engine thrust buildup were completed. The basic Saturn I holddown arm constrains the vehicle by clamping it between a fixed support and a movable jaw. The jaw is on a link pinned to rotate sufficiently to release the vehicle. There are three links in the jaw (restraining) system arranged so that with a small force provided by a pneumatic separator mechanism, the large loads of the vehicle can be restrained. Design details discussed are the link system, the separator, adjustments, and the energy absorber. The function of preloading is discussed. The secondary release system is

described along with the design differences between the Saturn I and the Saturn V arm. Author

N75-33110* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
CRAWLER TRANSPORTER STEERING AND JEL SYSTEMS c14
Virgil Leon Davis *In its* 9th Aerospace Mech. Symp. 1974 15 p (For availability see N75-33086 24-12)
CSCL 22D

The transporter weighing 2.8 million kilograms (6.3 million pounds) was used to lift a 5.7-million-kilogram (12.6-million-pound) combination of mobile launcher and space vehicle, transfer this load approximately 5.6 kilometers (3.5 miles) from its point of assembly, negotiate curves of 152-meter (500-foot) mean radius, climb a 5-percent grade while maintaining the 122-meter (400-foot) structure in a vertical position within 10 minutes of arc, and smoothly position this huge structure to within + or - 5.1 centimeters (+ or - 2 inches) on support pedestals at the launch pad. The crawler-transporter is described in detail. Author

N75-33111* Balke (Harry A.) Engineers, Cincinnati, Ohio.
MOUNT MECHANISMS FOR THE SATURN 5/APOLLO MOBILE LAUNCHER AT JOHN F. KENNEDY SPACE CENTER c14
Harry A. Balke *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 6 p (For availability see N75-33086 24-12)
CSCL 22D

A support system was designed to resist hurricane wind loads at the launch pad and to allow the supported structural frame to expand and contract freely under wide ranges of temperature. This system consists of six mount mechanisms devised to meet the previously stated requirements plus a load-carrying capacity for each of 3.2-million kilograms (7-million pounds) downward and 1.6-million kilograms (3.5-million pounds) upward. A similar but lighter system of six mount mechanisms was designed for use in the sheltered environment of the vehicle assembly building. Each requirement and design result is discussed, and each mount mechanism is defined by location and type with references to visual presentations. Author

N75-33112* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Design Section.
AUTOMATED PARKING GARAGE SYSTEM MODEL c85
Earl R. Collins, Jr. *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 9 p (For availability see N75-33086 24-12)
CSCL 13B

A one-twenty-fifth scale model of the key components of an automated parking garage system is described. The design of the model required transferring a vehicle from an entry level, vertically (+Z, -Z), to a storage location at any one of four storage positions (+X, -X, +Y, -Y) on the storage levels. There are three primary subsystems: (1) a screw jack to provide the vertical motion of the elevator, (2) a cam-driven track-switching device to provide X to Y motion, and (3) a transfer cart to provide horizontal travel and a small amount to vertical motion for transfer to the storage location. Motive power is provided by dc permanent magnet gear motors, one each for the elevator and track switching device and two for the transfer cart drive system (one driving the cart horizontally and the other providing the vertical transfer). The control system, through the use of a microprocessor, provides complete automation through a feedback system which utilizes sensing devices. Author

N75-33113*# National Aeronautics and Space Administration, Washington, D.C.
APOLLO SOYUZ TEST PROJECT, FIRST INTERNATIONAL MANNED SPACE FLIGHT, 15-24 JULY 1975
24 Jul. 1975 18 p refs
(NASA-TM-X-72877) Avail: NTIS HC $3.25 CSCL 22A

The joint space mission is briefly summarized. Spacecraft rendevous, docking, and recovery are discussed. Biographies of the joint crew members are included. J.R.T.

N75-33114*# IBM Federal Systems Div., Huntsville, Ala.
PROGRAM VERIFICATION DOCUMENT FOR THE ASTP FLIGHT PROGRAM
15 Apr. 1975 77 p refs
(NASA-CR-143958; IBM-75W-00067; MSFC-ASTP-DRL-686) Avail: NTIS HC $4.75 CSCL 22A

The various segments of the Apollo Soyuz Test Project (ASTP) flight program were verified. This included checks on the following: general verification, reference systems and transformations, launch preparations, boost navigation and guidance, orbital navigation and guidance, time bases, discretes, and interrupts, launch vehicle attitude control, switch selector processing, digital command system, real time telemetry and data compression, and algorithms. For individual titles, see N75-33115 through N75-33125.

N75-33115* IBM Federal Systems Div., Huntsville, Ala.
GENERAL VERIFICATION DESCRIPTION
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 3 p (For availability see N75-33114 24-12)
CSCL 22A

A brief general description of the ASTP flight program verification was presented. The total program verification effort assures the accuracy and adequacy of the LVDC flight program and verifies that the final program meets mission requirements and conforms to program documentation. The flight program's functional requirements to integrate the guidance and control system with the launch vehicle sequencing system are verified directly by analysis of many special logic checks designed for this purpose and indirectly by the correct overall program response to nominal and numerous perturbed conditions. Verification of the interaction of function requirements is accomplished on every case run during the verification effort. Author

N75-33116* IBM Federal Systems Div., Huntsville, Ala.
REFERENCE SYSTEMS AND TRANSFORMATIONS
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 3 p (For availability see N75-33114 24-12)
CSCL 22A

The verification accomplished to assure correct computation of the many geometrical relationships between the several coordinate systems and transformation matrices defined for the Saturn 1B mission was discussed. This is accomplished by demonstrating the following: (1) the program has the ability to correctly establish the initial vector coordinate system from external input data for use as a reference, (2) the program logic is capable of properly executing the calculations necessary to transform vectorial parameters from one coordinate system to another, and (3) the presettings used for vector component calculations are valid. Author

N75-33117* IBM Federal Systems Div., Huntsville, Ala.
PREPARED TO LAUNCH c14
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 2 p (For availability see N75-33114 24-12)
CSCL 22D

The verification of the interface between the preflight prepare-to-launch and flight program, targeting load, and flight program initialization was described. This is done using the digital command system coupled with a flight program patch and a memory dump command, the 6D/LVDC simulator, and a program trace through phase 1 initialization. Author

N75-33118* IBM Federal Systems Div., Huntsville, Ala.
BOOST NAVIGATION AND GUIDANCE c19
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 9 p (For availability see N75-33114 24-12)
CSCL 17G

The verification that the boost mode portion of the flight program correctly provides navigation and guidance functions for the vehicle during periods when significant, measurable accelerations exist was described. Many test cases and performance cases are made, testing the ability of the navigation and guidance routines to properly compensate for several perturbations. Various plots of special interest parameters are made on all performance cases, facilitating a check on each calculation (each boost major loop) of these parameters. Author

N75-33119* IBM Federal Systems Div., Huntsville, Ala.
ORBITAL NAVIGATION AND GUIDANCE c13
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 7 p (For availability see N75-33114 24-12) CSCL 17G

The verification of the orbital flight mode initialization, orbital navigation, orbital guidance, and telemetry acquisition functions was described. The output of the 6D/LVDC simulator is used for this verification. Author

N75-33120* IBM Federal Systems Div., Huntsville, Ala.
TIME BASES, DISCRETES, AND INTERRUPTS
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 10 p (For availability see N75-33114 24-12) CSCL 22A

The effort performed to assure proper flight program handling of time bases, discretes, and interrupts was discussed. The following time bases are used as key mission events: guidance reference release, liftoff, S-1B low level sensors dry, S-1B outboard engines cutoff, S-IVB cutoff, and S-IVB de-orbit DCS command. The five discrete outputs in the discrete output register were verified for proper setting. Each discrete input is honored in the proper time frame by forcing each discrete in the following intervals: before the discrete is enabled, after the discrete has been detected, and after the discrete has been disabled. As an assurance that an interrupt is honored only in the proper time frames, each interrupt was forced during the following intervals: prior to the specified enable time, after the interrupt has been honored, after the interrupt has been disabled. Author

N75-33121* IBM Federal Systems Div., Huntsville, Ala.
LAUNCH VEHICLE ATTITUDE CONTROL c13
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 4 p (For availability see N75-33114 24-12) CSCL 22A

The minor loop and minor loop support modules which maintain correct vehicle attitude control by generating vehicle attitude error signals were verified. The logic is checked during boost and orbit (unusual timing situations necessitate the additional orbit checks) and the constants used by these modules checked at every point during the flight. Since the same logic instructions are used throughout the flight with only the constants changing, verification of the logic at two points and the constants at all points verify the logic throughout the flight. Author

N75-33122* IBM Federal Systems Div., Huntsville, Ala.
SWITCH SELECTOR PROCESSING c13
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 3 p (For availability see N75-33114 24-12) CSCL 22A

The proper program execution of the switch selector commands that provide sequencing signals to the launch vehicle hardware was verified. Correct execution of each step necessary to activate a switch selector command and maintenance of the minimum timing requirements between steps are verified through analysis of a series of 6D/LVDC intermediate timing cases. Nominal and perturbed switch selector feedback conditions are simulated to verify correct processing of all realistic and timing combinations. A command which is in progress can be properly terminated by issuance of a forced reset. This is verified by forcing the conditions which require a forced reset and observing that the proper termination is completed. Author

N75-33123* IBM Federal Systems Div., Huntsville, Ala.
DIGITAL COMMAND SYSTEM c17
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 9 p (For availability see N75-33114 24-12) CSCL 22A

The correct processing of the Digital Command System (DCS), which provides a limited real-time means of controlling specific flight program functions, was verified. The ability of the flight program to correctly read and process DCS commands was verified. Tests made by the flight program after reading the contents of the command decoder register to establish the validity of the received data were verified through the following: DCS mode command verification, DCS data command verification, DCS data validation, and DCS error message. The operation of the following DCS commands accepted and processed by the flight program was tested: time base update, navigation update, generalized switch selector, memory dump, terminate, execute generalized maneuver, return to nominal timeline, ECS water control valve logic inhibit, execute maneuver, execute alternate sequence, targeting load, ladder magnitude limit, S-IVB/IU de-orbit, compressed data dump, and remove inhibit on the extraction maneuver. Author

N75-33124* IBM Federal Systems Div., Huntsville, Ala.
REAL TIME TELEMETRY AND DATA COMPRESSION c17
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 4 p (For availability see N75-33114 24-12) CSCL 17B

The generation of telemetry and data compression by the flight program was verified. The adequacy of flight program telemetry control and timing is proven by the analysis of simulation laboratory runs of past programs through the use of telemetry. The telemetry data are correctly issued using specific tags called process input/output (P10) tags. Verification is accomplished by ensuring that a specific P10 tag and mode register setting identifies the correct parameter and that the data are properly scaled for subsequent ground station reduction. It was checked that the LVDC telemetry correctly adheres to the general requirements specified by the EDD. Data compression specifications are verified using compressed data from nominal flight simulations and from a series of perturbations designed to test data table overflows, data dump rates, and compression of data for occurrence events. Author

N75-33125* IBM Federal Systems Div., Huntsville, Ala.
ALGORITHMS c60
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 15 p refs (For availability see N75-33114 24-12) CSCL 09B

The implementation of the algorithms used in the flight program to approximate elementary functions and mathematical procedures was checked. This was done by verifying that at least one, and in most cases, more than one function computed through the use of the algorithms was calculated properly. The following algorithms were checked: sine-cosine, arctangent, natural logarithm, square root, inverse square root, as well as the vector dot and cross products. Author

N75-33126*# IIT Research Inst., Chicago, Ill. Ceramics Research.
THEORETICAL STUDY OF PRODUCTION OF UNIQUE GLASSES IN SPACE Final Report, 1 Jul. 1973 - 31 Jan. 1975
D. C. Larsen and J. L. Sievert 23 May 1975 107 p refs (Contract NAS8-29850; IITRI Proj. D6087) (NASA-CR-143978) Avail: NTIS HC $5.25 CSCL 22A

The potential of producing the glassy form of selected materials in the weightless, containerless nature of space processing is examined through the development of kinetic relationships describing nucleation and crystallization phenomena. Transformation kinetics are applied to a well-characterized system (SiO_2), an excellent glass former (B_2O_3), and a poor glass former (Al_2O_3) by conventianal earth processing methods. Viscosity and entropy of fusion are shown to be the primary materials parameters controlling the glass forming tendency. For multicomponent systems diffusion-controlled kinetics and heterogeneous nucleation effects are considered. An analytical empirical approach is used to analyze the mullite system. Results are consistent with experimentally observed data and indicate the promise of mullite as a future space processing candidate. Author

N75-33127*# Auburn Univ., Ala. Engineering Experiment Station.
ECONOMIC ANALYSIS OF MATERIALS PROCESSING IN SPACE Final Report, Mar. 1974 - Jun. 1975
R. I. Vachon, R. C. Wilcox, A. W. Lacy, C. W. Hale, S. D. Beckett, and J. B. Canterberry 15 Jun. 1975 265 p refs (Contract NAS8-29881) (NASA-CR-143965) Avail: NTIS HC $8.50 CSCL 22A

The cost benefits and the feasibility of processing turbine

blades, electrophoresis, and crystals in space were studied. For individual titles, see N75-33128 through N75-33135.

N75-33128* Auburn Univ., Ala.
ECONOMIC ANALYSIS OF MATERIALS PROCESSING IN SPACE: INTRODUCTION
In its Econ. Analysis of Materials Processing in Space 15 Jun. 1975 p 1-7 (For availability see N75-33127 24-12)
CSCL 22A

Space processing concepts investigated included an unmanned space factory, and a permanently launched factory. Product lines chosen for analysis were: (1) turbine blades, (2) tungsten targets for X-ray machines, (3) 1 sub G subclass separation by electrophoresis, and (4) high-price exotic crystals. The turbine blade, and 1 sub G products are considered promising candidates. F.O.S.

N75-33129* Auburn Univ., Ala.
SPACE SHUTTLE **c18**
In its Econ. Analysis of Materials Processing in Space 15 Jun. 1975 p 8-39 refs (For availability see N75-33127 24-12)
CSCL 22B

The transportation cost associated with space materials processing were studied to determine the feasibility of space manufacturing. The assumptions use to determining the cost estimates for a 12 year planning period are listed, and the orbitor is described in terms of payloads. Shuttle operational costs, ground operational costs, and nonrecurring investment and development costs were analyzed. F.O.S.

N75-33130* Auburn Univ., Ala.
COSTS AND BENEFITS OF TURBINE BLADES
In its Econ. Analysis of Materials Processing in Space 15 Jun. 1975 p 40-90 refs (For availability see N75-33127 24-12)
CSCL 14A

The potential demand for space processed turbine blades, and the dollar benefits to be derived from this technology were analyzed. It was found that an adequate demand to justify space processed blades will exist. The cost benefits per blade for replacements in existing aircraft is estimated to be $997.50 per blade, and for new aircraft the savings per blade would be over $21,000.00. F.O.S.

N75-33131* Auburn Univ., Ala.
TURBINE BLADE PROCESSING
In its Econ. Analysis of Materials Processing in Space 15 Jun. 1975 p 91-158 refs (For availability see N75-33127 24-12)
CSCL 13H

Space processing of directionally solidified eutectic-alloy type turbine blades is envisioned as a simple remelt operations in which precast blades are remelted in a preformed mold. Process systems based on induction melting, continuous resistance furnaces, and batch resistance furnaces were evaluated. The batch resistance furnace type process using a multiblade mold is considered to offer the best possibility for turbine blade processing. Author

N75-33132* Auburn Univ., Ala.
HIGH PURITY TUNGSTEN TARGETS
In its Econ. Analysis of Materials Processing in Space 15 Jun. 1975 p 159-176 refs (For availability see N75-33127 24-12)
CSCL 13H

High purity tungsten, which is used for targets in X-ray tubes was considered for space processing. The demand for X-ray tubes was calculated using the growth rates for dental and medical X-ray machines. It is concluded that the cost benefits are uncertain. F.O.S.

N75-33133* Auburn Univ., Ala.
ELECTROPHORESIS OF BIOLOGICAL MATERIALS
In its Econ. Analysis of Materials Processing in Space 15 Jun. 1975 p 177-190 refs (For availability see N75-33127 24-12)
CSCL 06C

The selection of biological products was studied for electrophoresis in space. Free flow electrophoresis, isoelectric focusing, and isotachophoresis are described. The candidates discussed include: immunoglobulins and gamma globulins; isolated islet of langerhans from pancreas; bone marrow; tumor cells; kidney cells, cryoprecipitate; and column separated cultures. F.O.S.

N75-33134* Auburn Univ., Ala.
CRYSTAL STUDY AND ECONOMETRIC MODEL
In its Econ. Analysis of Materials Processing in Space 15 Jun. 1975 p 191-233 refs (For availability see N75-33127 24-12)
CSCL 20B

An econometric model was developed that can be used to predict demand and supply figures for crystals over a time horizon roughly concurrent with that of NASA's Space Shuttle Program - that is, 1975 through 1990. The model includes an equation to predict the impact on investment in the crystal-growing industry. Actually, two models are presented. The first is a theoretical model which follows rather strictly the standard theoretical economic concepts involved in supply and demand analysis, and a modified version of the model was developed which, though not quite as theoretically sound, was testable utilizing existing data sources. Author

N75-33135* Auburn Univ., Ala.
SUMMARY AND RECOMMENDATIONS
In its Econ. Analysis of Materials Processing in Space 15 Jun. 1975 p 234-251 refs (For availability see N75-33127 24-12)
CSCL 13H

An economic analysis using econometric and cost benefit analysis techniques was performed to determine the feasibility of space processing of certain products. The overall objectives of the analysis were (1) to determine specific products or processes uniquely connected with space manufacturing, (2) to select a specific product or process from each of the areas of semiconductors, metals, and biochemicals, and (3) to determine the overall price/cost structure of each product or process considered. The economic elements of the analysis involved a generalized decision making format for analyzing space manufacturing, a comparative cost study of the selected processes in space vs. earth manufacturing, and a supply and demand study of the economic relationships of one of the manufacturing processes. Space processing concepts were explored. The first involved the use of the shuttle as the factory with all operations performed during individual flights. The second concept involved a permanent unmanned space factory which would be launched separately. The shuttle in this case would be used only for maintenance and refurbishment. Finally, some consideration was given to a permanent manned space factory. Author

N75-33136*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
APOLLO-SOYUZ TEST FLIGHT
A. A. Bolshoy Washington NASA Sep. 1975 18 p Transl. into ENGLISH from Priroda (USSR), no. 6, Jun. 1975 p 2-7
(Contract NASw-2789)
(NASA-TT-F-16541) Avail: NTIS HC $3.25 CSCL 22A

Docking, an integral element in space technology in regard to the functioning of manned space stations and when rendering assistance to other spacecraft in emergency situations, is discussed. To provide for the compatibility of docking space vehicles and their control systems, four conditions must be fulfilled: standardizing docking devices, the establishment of intercoordination relative to other on-board systems, developing compatibility of life-support systems, and organizing unified control. A description of the upcoming Apollo-Soyuz flight, including a basic flight schedule and some of the operations to be accomplished by the cosmonauts, and astronauts, is included. Author

N75-33137*# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
SEGREGATION EFFECTS DURING SOLIDIFICATION IN WEIGHTLESS MELTS Final Report
Chou Li Jul. 1975 164 p refs
(Contract NAS8-29662)
(NASA-CR-143981; RE-507) Avail: NTIS HC $6.25 CSCL 22A

Computer programs are developed and used in the study of the combined effects of evaporation and solidification in space processing. The temperature and solute concentration profiles during directional solidification of binary alloys with surface evaporation were mathematically formulated. Computer results are included along with an econotechnical model of crystal growth.

This model allows: prediction of crystal size, quality, and cost; systematic selection of the best growth equipment or alloy system; optimization of growth or material parameters; and a maximization of zero-gravity effects. Segregation in GaAs crystals was examined along with vibration effects on GaAs crystal growth. It was found that a unique segregation pattern and strong convention currents exist in GaAs crystal growth. Some beneficial effects from vibration during GaAs growth were discovered. The implications of the results in space processing are indicated. Author

N75-33138*# Vanderbilt Univ., Nashville, Tenn. School of Medicine.
RESEARCH AND OPERATIONAL EFFORTS IN SUPPORT OF SKYLAB EXPERIMENT M093 Final Report
Raphael F. Smith Nov. 1974 36 p refs
(Contracts NAS9-12889; NASA Order T-23237-G; N00014-71-A-0212-0001)
(AD-A001762) Avail: NTIS CSCL 06/2

The objectives of Skylab Experiment M093 were to measure electrocardiographic signals during spaceflight, to elucidate the electrophysiological basis for the changes observed, and to assess the effect of the change on the human cardiovascular system. Vectorcardiographic methods were used to quantitate changes, standardize data collection, and to facilitate reduction and statistical analysis of data. In this report the authors describe the M093 experiment design, the data transmission system, data reduction methods, and the analysis of data from the three Skylab missions. The report also includes clinical applications of the techniques developed for Skylab Experiment M093. GRA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N75-33139* National Aeronautics and Space Administration, Washington, D.C.
ATMOSPHERE EXPLORER SET FOR LAUNCH
22 Sep. 1975 22 p
(NASA-News-Release-75-259) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8756, Baltimore/Washington International Airport, Md. 21240 CSCL 22A

The Atmosphere Explorer-D (Explorer-54) is described which will explore in detail an area of the earth's outer atmosphere where important energy transfer, atomic and molecular processes, and chemical reactions occur that are critical to the heat balance of the atmosphere. Data are presented on the mission facts, launch vehicle operations, AE-D/Delta flight events, spacecraft description, scientific instruments, tracking, and data acquisition. M.J.S.

N75-33140*# Kanner (Leo) Associates, Redwood City, Calif.
OPTIMIZATION OF A PROGRAM FOR DETERMINING SPACE OBJECTS' TRAJECTORIES WHEN ERRORS ARE PRESENT IN THE MOTION MODEL
P. M. Vingardt Washington NASA Oct. 1975 18 p refs Transl. into ENGLISH from "Ob Optimizatsii Programmy Opred. Trayektorii Kosmicheskogo Objecta pri Nalichii Oshibok Modeli Dvizheniya", Moscow, USSR Acad. of Sci., Inst. of Space Res., 1975 14 p
(Contract NASw-2790)
(NASA-TT-F-16608; Pr-217) Avail: NTIS HC $3.25 CSCL 22C

A program, which determines the trajectory of a space object is optimized. It is assumed that the errors of the mathematical motion model are nonrandom and can be represented as Fourier series. The coefficients of these series are subdivided into two groups. The values of the coefficients of the first group are to be determined, and the coefficients of the second group are assumed equal to zero. This subdivision depends on the choice of the trajectory parameter to be estimated and is found by solving some problem in quadratic programming. Author

N75-33141*# Auburn Univ., Ala. Dept. of Aerospace Engineering.
TERMINAL GUIDANCE AND NAVIGATION FOR COMET AND ASTEROID RENDEZVOUS Final Report
Arthur G. Bennett and Robert G. Pitts 15 Jun. 1975 71 p refs
(Contract NAS8-30248)
(NASA-CR-143988) Avail: NTIS HC $4.25 CSCL 22A

A terminal guidance and navigation scheme developed in earlier work was modified and evaluated for a solar electric propulsion rendezvous mission to comet Encke. The scheme is intended for autonomous, on-board use. The guidance algorithm is based on optimal control theory and minimizes the time integrated square of thrust acceleration. The navigation algorithm employs a modified Kalman filter set in measurement variables. Random sequences were generated to simulate measurement errors, and the evaluation was conducted with detailed numerical computations which include actual motions of spacecraft and comet. The evaluations showed that the scheme attains rendezvous and maintains station after rendezvous within less than 10 km for estimated best measurements and within less than 100 km for estimated worst measurements. The measurements required are angles, range, and range rate. Angles and range appear to be absolutely necessary; range rate is not as strong a measurement type, and further modifications of the filter will allow a scheme that does not require the rate measurements. Author

N75-33142*# Wisconsin Univ., Madison. Space Astronomy Lab.
STUDY FOR APPLICATION OF A SOUNDING ROCKET EXPERIMENT TO SPACELAB/SHUTTLE MISSION Final Report
Arthur D. Code Aug. 1975 83 p refs
(Contract NAS5-20973)
(NASA-CR-144677) Avail: NTIS HC $4.75 CSCL 22A

An inexpensive adaptation of rocket-size packages to Spacelab/Shuttle use was studied. A two-flight project extending over two years was baselined, requiring 80 man-months of effort. It was concluded that testing should be held to a minimum since rocket packages seem to be able to tolerate shuttle vibration and noise levels. A standard, flexible control and data collection language such as FORTH should be used rather than a computation language such as FORTRAN in order to hold programming costs to a minimum. Author

N75-33143# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PLACING A GEOSTATIONARY SATELLITE INTO ORBIT: OPTIMIZATION OF TRANSFER ORBIT, APOGEE IMPULSE, AND FINAL RENDEZVOUS [ETUDE DE LA MISE EN PLACE D'UN SATELLITE GEOSTATIONNAIRE: OPTIMISATION DE L'ORBITE DE TRANSFERT, DE L'IMPULSION D'APOGEE ET DU RENDEZ-VOUS FINAL]
D. Biausse and C. Aumasson Feb. 1975 192 p refs In FRENCH
(Contract ESOC-552/73-T)
(RTS-3/3081-SY; ESA-CR(P)-667) Avail: NTIS HC $7.00

The optimal procedure for placing a geostationary satellite into final orbit from the transfer orbit in the presence of operational constraints is analyzed. The maneuver consists of the application of a velocity increase near the apogee of the transfer orbit, and then final positioning. The final placing is dealt with under the constraints of satellite orientation (solar aspect) and of duration of the final rendezvous. The optimization of the apogee impulse and of certain transfer orbital parameters is complicated by visibility constraints for observation from the ground. An independent numerical simulation was carried out to verify the quality of the analytical solutions obtained. ESA

N75-33144# Analytical and Computational Mathematics, Zurich (Switzerland).
CONSERVATIVE FILTERING FOR ORBIT DETERMINATION, VOLUME 1
S. J. Larcher Mar. 1975 128 p refs 2 Vol.
(Contract ESOC-551/73-AR)
(ESA-CR(P)-668) Avail: NTIS HC $5.75

A theory of conservative filtering for real time orbit determination was developed which fulfills the requirements of reliability under all circumstances and of compatibility with a computational

load stemming from the real time application. The fundamental concept upon which the development of the theory is based, is to treat systems nonlinearities, as well as possible modeling errors, which are the most serious sources of filter divergence, as fictitious noise for which suitable characteristics are derived for model equations. ESA

N75-33145# Analytical and Computational Mathematics, Zurich (Switzerland).
CONSERVATIVE FILTERING FOR ORBIT DETERMINATION. VOLUME 2: APPENDICES
S. J. Larcher Mar. 1975 72 p 2 Vol.
(Contract ESOC-551/73-AR)
(ESA-CR(P)-669) Avail: NTIS HC $4.25

Detailed mathematical treatment of some problems discussed in the theory of conservative filtering for real time orbit determination is presented. ESRO

N75-33146# Naval Surface Weapons Center, Dahlgren, Va.
MULTIPLE SATELLITE ORBIT DETERMINATION FOR NEIGHBORING SATELLITES
Patrick J. Fell Apr. 1975 33 p refs
(AD-A010129; NSWC/DL-TR-3308) Avail: NTIS CSCL 22/3

If satellites follow orbit paths within one hundred kilometers of each other, (I) the simultaneous processing of orbital data using a multiple satellite orbit determination method produces ephemerides for the satellites with an accuracy consistent with individually determined orbits. However this method predicts the relative separation of the satellites more accurately in the presence of modeling errors. (II) The use of perturbation solutions from the integration of one satellite's variational equations to process the other satellite's tracking data introduces a small additional error into orbit solutions. But such a procedure can substantially reduce computation time required to compute the orbits of the satellites. Based on this analysis it is recommended that a multiple satellite data processing scheme be adopted for satellites in neighboring orbits. GRA

N75-33147# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MAXIMUM PERMISSIBLE LOAD ON THE FRONTAL SURFACE OF VEHICLES, WHICH IMPLEMENT AERODYNAMIC DESCENT IN THE ATMOSPHERE OF MARS
N. M. Ivanov and A. I. Martynov 7 Feb. 1975 27 p refs
Transl. into ENGLISH from Tsentr. Aerogidrodinamicheskii Inst. Uch. Zap. (USSR), v. 2, no. 3, 1971 p 105-109
(AD-A006854; FTD-MT-24-0580-75) Avail: NTIS CSCL 22/2

The descent of ballistic type vehicles into the rarefied atmosphere of Mars is examined in terms of the effect of aerodynamic loads on the frontal surface of vehicles. It is shown that a soft landing is feasible only under the following conditions: presence of autonomous navigation aids on-board the vehicle, and a small lift-to-drag ratio. J.M.S.

N75-33119* IBM Federal Systems Div., Huntsville, Ala.
ORBITAL NAVIGATION AND GUIDANCE
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 7 p (For availability see N75-33114 24-12)
CSCL 17G

N75-33121* IBM Federal Systems Div., Huntsville, Ala.
LAUNCH VEHICLE ATTITUDE CONTROL
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 4 p (For availability see N75-33114 24-12)
CSCL 22A

N75-33122* IBM Federal Systems Div., Huntsville, Ala.
SWITCH SELECTOR PROCESSING
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 3 p (For availability see N75-33114 24-12)
CSCL 22A

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N75-33108* General Dynamics Corp., San Diego, Calif. Convair Aerospace Div.
A DAMPER FOR GROUND WIND-INDUCED LAUNCH VEHICLE OSCILLATIONS
John G. Bodle and David S. Hackley *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 23 p (For availability see N75-33086 24-12)
CSCL 22D

N75-33109* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
HOLDDOWN ARM RELEASE MECHANISM USED ON SATURN VEHICLES
J. D. Phillips and B. A. Tolson *In its* 9th Aerospace Mech. Symp. 1974 24 p (For availability see N75-33086 24-12)
CSCL 22D

N75-33110* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
CRAWLER TRANSPORTER STEERING AND JEL SYSTEMS
Virgil Leon Davis *In its* 9th Aerospace Mech. Symp. 1974 15 p (For availability see N75-33086 24-12)
CSCL 22D

N75-33111* Balke (Harry A.) Engineers, Cincinnati, Ohio.
MOUNT MECHANISMS FOR THE SATURN 5/APOLLO MOBILE LAUNCHER AT JOHN F. KENNEDY SPACE CENTER
Harry A. Balke *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 6 p (For availability see N75-33086 24-12)
CSCL 22D

N75-33117* IBM Federal Systems Div., Huntsville, Ala.
PREPARED TO LAUNCH
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 2 p (For availability see N75-33114 24-12)
CSCL 22D

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N75-33148*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER CONTROLLED VENT AND PRESSURIZATION SYSTEM
E. J. Cieslewicz 1975 23 p Presented at Natl. Conf. on Fluid Power, Chicago, 21-23 Oct. 1975
(NASA-TM-X-71755; E-8440) Avail: NTIS HC $3.25 CSCL 22D

The Centaur space launch vehicle airborne computer, which was primarily used to perform guidance, navigation, and sequencing tasks, was further used to monitor and control inflight pressurization and venting of the cryogenic propellant tanks. Computer software flexibility also provided a failure detection and correction capability necessary to adopt and operate redundant hardware techniques and enhance the overall vehicle reliability. Author

N75-33149# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
STUDY OF PAP LAUNCH SYSTEM IMPACT ON APPLICA-

TION SATELLITES Final Report
Dec. 1974 191 p
(Contract ESRO-SC/26-HQ)
(MBB-UR-V-79-74; ESRO-CR(P)-649) Avail: NTIS HC $7.00

The channel economics for a direct TV satellite in the 14 GHz range with 4 or 5 channels were investigated for post-Apollo launch facilities, such as space shuttle and tug. It is shown that shuttle phase kickstage and shuttle/tug improve the channel economy by a factor of 2 compared to conventional launch vehicles because their payload capability allows for increased built-in redundancy and lifetime of application satellites. Shuttle system facilitates design and fabricate of only those subsystems which have very low impact on system cost. Retrieval missions, combined with repair on the ground, do not increase the channel economy of a TV satellite. A multi-nations service network results in further cost reduction per channel and year. Any possible improvement of the satellite design life results in lower channel cost per year due to the high unit production cost of this type of communication satellite. ESA

N75-33150# Groupe des Recherches Ionospheriques, Paris (France).
LAUNCH WINDOWS FOR THE ARAKS EXPERIMENT [ETUDE DES CRENEAUX DE TIRS DE L'EXPERIENCE 'ARAKS']
J. P. Legrand 10 May 1974 21 p In FRENCH
(GRI/NTP/128) Avail: NTIS HC $3.25

The necessary conditions for successful launch of the two sounding rockets of the ARAKS experiment were presented. The astronomical conditions at Kerguelen and Sogra were reviewed, leading to three possible launch windows. The conditions are further refined by the need for geomagnetic quiet conditions at the launch site and magnetic conjugate observation point. The meteorological conditions are described. Author (ESA)

N75-33151# Royal Aircraft Establishment, Farnborough (England).
SPACE VEHICLES LAUNCHED DURING 1973 AND 1974
J. A. Pilkington 15 Jan. 1975 13 p Supersedes RAE-TM-Space-205; N74-33356
(RAE-TM-SPACE-219; BR46337; RAE-TM-SPACE-205) Avail: NTIS HC $3.25

All successfully launched space vehicles are listed according to their orbits. Information is given on launch date, mass and basic shape, basic size, perihelion, aphelion, eccentricity, inclination to elliptic, and period. ESA

N75-33152# Naval Surface Weapons Center, Dahlgren, Va.
A PROCEDURE FOR COMPARING ELECTRICAL CENTER AND INERTIAL CENTER POSITION DIFFERENCES FOR GRAVITY GRADIENT STABILIZED SATELLITES
David J. Lehman Apr. 1975 22 p refs
(AD-A010128; NSWC/DL-TR-3246) Avail: NTIS CSCL 22/3

For Timation satellites, the position of the antennae transmitting signals used for Doppler tracking differs from the satellite's center of gravity. As satellite tracking improves and more precise applications are rendered to satellite work, this difference may be significant. This report describes a procedure for computing the difference between the inertial and electrical centers and for relating this difference to a geocentric coordinate system as a function of the satellite's position and velocity. GRA

N75-33153# Naval Surface Weapons Center, Dahlgren, Va.
MULTIPLE SATELLITE DATA PROCESSING FOR THE NAVSTAR GLOBAL POSITIONING SYSTEM
Patrick J. Fell Oct. 1974 35 p refs
(AD-A000957; NSWC/DL-TR-3210) Avail: NTIS CSCL 17/7

A least squares method is presented for the solution of orbital and bias parameters for multiple Global Positioning System satellites being observed by a common station array. The effects of radiation pressure modelling errors on timing solutions are examined for both multiple and single satellite processing using a time equation consisting of a bias and linear drift term. Results indicate that the errors in orbital and timing solutions caused by modeling errors in radiation pressure are reduced by the multiple satellite processing scheme. However, adequate time solutions from single satellite processing are achievable if accurate radiation pressure modeling is available. GRA

N75-33087* General Dynamics/Convair, San Diego, Calif.
FORWARD BEARING REACTOR MECHANISM FOR TITAN 3-E/CENTAUR D-1T SPACE LAUNCH VEHICLE
Richard A. Jones *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 19 p (For availability see N75-33086 24-12)
CSCL 22D

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N75-33154*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWENTY AND THIRTY GHz MILLIMETER WAVE EXPERIMENTS WITH THE ATS-6 SATELLITE
Louis J. Ippolito, comp. Aug. 1975 199 p refs Submitted for publication
(NASA-TM-X-70994; X-951-75-211) Avail: NTIS HC $7.00
CSCL 17B

The ATS-6 millimeter wave experiment, provided the first direct measurements of 20 and 30 GHz earth-space links from an orbiting satellite. Studies at eleven locations in the continental United States were directed at an evaluation of rain attenuation effects, scintillations, depolarization, site diversity, coherence bandwidth, and analog and digital communications techniques. In addition to direct measurements on the 20 and 30 GHz links, methods of attenuation prediction with radars, rain gages, and radiometers were developed and compared with the directly measured attenuation. Initial data results of the ATS-6 millimeter wave experiment from the major participating organizations are presented. Author

N75-33155*# Kanner (Leo) Associates, Redwood City, Calif.
INTERKOSMOS: SUMMER SCHOOL FOR OBSERVERS WITH LASER SATELLITE RANGEFINDERS
P. Navara Washington NASA Sep. 1975 133 p refs Transl. into ENGLISH from "INTERKOSMOS. Letnyaya Shkola Nablyudateley Lazernym Sputnikovym Dalnomerom" Prague, Czech. Acad. of Sci., 1974 p 1-175
(Contract NASw-2790)
(NASA-TT-F-16543) Avail: NTIS HC $5.75 CSCL 20E

Papers are presented which deal with the theory, instruments, and techniques of satellite rangefinding using laser methods. The topics covered include: the first INTERKOSMOS laser satellite rangefinder, digital measurement of time intervals, the time base of a laser satellite rangefinder, optical corner reflectors for laser rangefinding, and laser rangefinding to the moon. Theoretical papers discuss the fundamentals of satellite geodesy, the orbits of artificial satellites, computing the ephemerides of artificial earth satellites, and predicting the time periods which are favorable for photographing passive artificial earth satellites. Author

N75-33156*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
THE OSU 275 SYSTEM OF SATELLITE TRACKING STATION COORDINATES

Ivan I. Mueller and Muneendra Kumar Aug. 1975 33 p refs (Grant NGR-36-008-093; OSURF Proj. 2514)
(NASA-CR-119099; Rept-228) Avail: NTIS HC $3.75 CSCL 17B

A brief review of the methods and data used in the OSU 275 geodetic system is given along with the summary of the results. Survey information regarding the tracking stations in the system is given in tabular form along with the geodetic and geophysical parameters, origin and orientation, Cartisian coordinates, and systematic differences with global and nonglobal geodetic systems. M.J.S.

N75-33157# Groupe des Recherches Ionospheriques, Paris (France).
A PCM PRIMARY SYNCHRONIZING UNIT [ETUDE D'UN SYNCHRONISATEUR PRIMAIRE DE PCM]
P. Fortin Jul. 1974 49 p In FRENCH
(GRI/NTP/133) Avail: NTIS HC $3.75

A study of a primary PCM telemetry synchronizer is presented. The basic principles of PCM are reviewed together with the various codes used. The modulated carrier spectrum and energy contents in a frequency band are discussed. Reception problems are detailed leading to the conception of a primary synchronizer executed in TTL and modified for CMOS circuits. ESA

N75-33158# Aerospace Corp., El Segundo, Calif.
TRAJECTORY RECONSTRUCTION PROGRAM MILESTONE 2/3 REPORT. VOLUME 1: DESCRIPTION AND OVERVIEW
M. J. Rademacher and W. F. Rearick 16 Dec. 1974 513 p refs
(Contract F04701-74-C-0075)
(AD-A009842; TR-0075(9320)-3-Vol-1; SAMSO-TR-75-90-Vol-1) Avail: NTIS CSCL 16/2

The Trajectory Reconstruction Program (TRP) system consists of vehicle simulation subprograms designed and written in FORTRAN for CDC 6600/7600, IBM 360/370, and UNIVAC 1108/1110 series computers. The overall simulation system has been designed to accommodate extreme variations in vehicle configuration, flight profile, and mission objective and to provide a fast reaction to specific simulations at minimal cost. This simulation system consists of a family of computer subprograms from which a judicious selection can be made to form a specific simulation system for a particular simulation task. Two major design features of the TRP system make it general and versatile. Its modular construction concept (each module contains several models) allows the user to choose those suited to his simulation. Variations in flight profile are accommodated by input at event times only. GRA

N75-33159# Mission Research Corp., Santa Barbara, Calif.
STRIATION PROPERTIES AFFECTING SATELLITE COMMUNICATION SYSTEMS Topical Report, Apr. - Aug. 1974
N. J. Carron 20 Feb. 1975 69 p refs
(Contract DNA001-74-C-0145; DNA Proj. NWED-QAXHC065)
(AD-A010800; MRC-R-154; DNA-3541T) Avail: NTIS CSCL 17/2

The report describes the effects of a striated nuclear environment on the performance of digital satellite communication systems. It discusses the theoretical propagation analysis and provides evidence to justify its applicability. Formulas for the binary bit error probabilities for three modulation techniques as a function of mean signal-to-noise ratio and signal scintillation strength are given. The parameters describing the striated environment are discussed and the important parameters that affect a digital satellite communication system are identified. The most important parameters are the path integral of the rms electron density fluctuations, the effective striation size, the overall horizontal and vertical extent of the striated environment, and the lifetime of the striated environment. GRA

N75-33123* IBM Federal Systems Div., Huntsville, Ala.
DIGITAL COMMAND SYSTEM
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 9 p (For availability see N75-33114 24-12) CSCL 22A

N75-33124* IBM Federal Systems Div., Huntsville, Ala.
REAL TIME TELEMETRY AND DATA COMPRESSION
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 4 p (For availability see N75-33114 24-12) CSCL 17B

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N75-33160*# Scientific Translation Service, Santa Barbara, Calif.
SALYUT-4: EQUIPMENT AND POTENTIALS
M. Kasimova Washington NASA Oct. 1975 10 p Transl. into ENGLISH from Aviatsiya i Kosmonavtika (USSR), no. 7, Jul. 1975 p 26-27
(Contract NASw-2791)
(NASA-TT-F-16582) Avail: NTIS HC $3.25 CSCL 22B

A description is given of the docking of Salyut-4 and Soyuz-17. It includes a detailed description of the spacecraft interior and equipment. Author

N75-33161*# Kanner (Leo) Associates, Redwood City, Calif.
BAYKONUR-CANAVERAL: A COMMON PROGRAM
M. F. Rebrov Washington NASA Oct. 1975 14 p Transl. into ENGLISH from Zemlya Vselennaya (USSR), no. 3, May-Jun. 1975 p 21-27
(Contract NASw-2790)
(NASA-TT-F-16579) Avail: NTIS HC $3.25 CSCL 22B

American and Soviet approaches to the designing of spacecraft for the Apollo-Soyuz test mission are described. Hazards in matching docking units are evaluated and precautions are outlined. Conversations between Soviet and American technical directors of the mission are recounted. Author

N75-33162*# Chrysler Corp., New Orleans, La.
RESULTS OF A 0.03- SCALE AERODYNAMIC CHARACTERISTICS INVESTIGATION OF BOEING 747 CARRIER (MODEL NO. AX 1319 I-1) MATED WITH A SPACE SHUTTLE ORBITER (MODEL 45-0) CONDUCTED IN THE BOEING TRANSONIC WIND TUNNEL (CA5), VOLUME 1
D. Sarver, T. L. Mulkey, and R. H. Lindahl Aug. 1975 795 p
(Contract NAS9-13247)
(NASA-CR-141800; DMS-DR-2211-Vol-1) Avail: NTIS HC $15.25 CSCL 22B

The performance, stability, and control characteristics of various carrier aircraft configurations are presented. Aerodynamic characteristics of the carrier mated with the Orbiter, carrier alone, and Orbiter alone were investigated. Carrier support system tare and interference effects were determined. Six-component force and moment data were recorded for the carrier and Orbiter. Buffet onset characteristics of the carrier vertical tail and horizontal tail were recorded. Angles of attack from -3 deg through 26 deg and angles of slideslip between +12 deg and -12 deg were investigated at Mach numbers from 0.15 through 0.70. Photographs are included. Author

N75-33163*# Chrysler Corp., New Orleans, La. Data Management Services.
RESULTS OF A 0.03-SCALE AERODYNAMIC CHARACTERISTICS INVESTIGATION OF A BOEING 747 CARRIER (MODEL NO. AX 1319 I-1) MATED WITH A SPACE SHUTTLE ORBITER (MODEL 45-0) CONDUCTED IN THE BOEING TRANSONIC WIND TUNNEL (CA5), VOLUME 2 Aerothermodynamic Data Report
D. Sarver, T. L. Mulkey, and R. H. Lindahl Aug. 1975 716 p
(Contract NAS9-13247)
(NASA-CR-141803; DMS-DR-2211-Vol-2) Avail: NTIS HC $15.25 CSCL 22B

For abstract, see N75-33162.

N75-33164*# Chrysler Corp., New Orleans, La. Data Management Services.
RESULTS OF A 0.03-SCALE AERODYNAMIC CHARACTERISTICS INVESTIGATION OF A BOEING 747 CARRIER (MODEL NO. AX 1319 I-1) MATED WITH A SPACE SHUTTLE ORBITER (MODEL 45-0) CONDUCTED IN THE BOEING TRANSONIC WIND TUNNEL (CA5) Aerothermodynamic Data Report
D. Sarver, T. L. Mulkey, and R. H. Lindahl Aug. 1975 657 p (Contract NAS9-13247)
(NASA-CR-141804; DMS-DR-2211-Vol-3) Avail: NTIS HC $13.25 CSCL 22B
For abstract, see N75-33162.

N75-33165# European Space Research and Technology Center, Noordwijk (Netherlands).
THE OUTGASSING OF SPACE MATERIALS AND ITS MEASUREMENT
J. Dauphin and A. Zwaal Paris ESRO Feb. 1975 20 p refs Presented at the conf. on Simulation et Espace, Toulouse, 10-14 Sep. 1973
(ESRO-TN-124-ESTEC) Avail: NTIS HC $3.25
The results are presented of several correlation tests performed on various kinds of outgassing apparatus to standardize the micro-VCM method. These tests were carried out by ESA, the Goddard Space Flight Center, and the Jet Propulsion Laboratory, on a series of identical specimens. For total outgassing, the correlation was found to be correct, except for epoxy resins and Kinel 5505; this is being verified for a second series of specimens. ESA

N75-33166# Hawker Siddeley Dynamics Ltd., Hatfield (England). Space Div.
EVALUATION OF THE ESRO 4 ATTITUDE CONTROL AND STABILISATION TELEMETRY DATA
L. Flook, comp. and M. Burton, comp. Jun. 1975 243 p refs (Contract ESTEC-2065/73-AK)
(HSD-TP-7526; ESA-CR(P)-675) Avail: NTIS HC $7.50
The performance of the ESRO 4 attitude control and stabilization system was investigated using telemetry data collected during the life of the satellite. Factors examined include: spine rate variations, attitude determination, attitude drift, and attitude maneuvers. A thermal expansion model was used which gave good correlation with measured spin rate variations which occurred during and after eclipsing. It was shown that a small improvement in the attitude determination accuracy could be obtained by modification of the criterion used during the mission. Good correlation was obtained between predicted and actual attitude drift and the reorientation errors were found to be consistent with the effects of predicted error sources.
Author (ESA)

N75-33167# ARO, Inc., Arnold Air Force Station, Tenn.
PITCH-, YAW-, AND ROLL-DAMPING CHARACTERISTICS OF A SHUTTLE ORBITER AT FREE STREAM MACH 8 Final Report, 24 Jun. - 25 Jul. 1974
Bob L Uselton and Leroy M. Jenke AEDC May 1975 37 p refs Sponsored by AF
(AF Proj. 9692; ARO Proj. VA498; ARO Proj. V41B-48a)
(AD-A011648; ARO-VKF-TR-74-100; AEDC-TR-74-129) Avail: NTIS CSCL 22/1
Wind tunnel tests were conducted at free stream M 8 to determine the pitch-, yaw-, and roll-damping characteristics of a modified 089B shuttle orbiter configuration. Data were obtained utilizing the small-amplitude forced-oscillation technique. The orbiter was dynamically stable in pitch, yaw, roll, and statically unstable in yaw for the moment reference of the test configurations. The pitch derivatives were dependent on Reynolds number while the roll derivatives were independent of Reynolds number.
Author

N75-33168# Chrysler Corp., New Orleans, La. Space Div.
AN EXPERIMENTAL INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF SEVERAL NOSE-MOUNTED CANARD CONFIGURATIONS AT TRANSONIC MACH NUMBERS
James R. Burt, Jr. 30 Aug. 1974 873 p refs
(Contract DAAH03-74-C-0405)
(AD-A006483; DMS-AR-1022; RD-TR-75-2) Avail: NTIS CSCL 16/4
Experimental aerodynamic investigations were conducted at the CALSPAN Corporation's transonic wind tunnel to determine the aerodynamic characteristics of several nose-mounted canard wing configurations. Canard position, geometry, angular orientation, and model nose shape were varied systematically to determine their effects on model aerodynamics. Angle of attack was varied from -3 to 12 degrees and Mach number was varied from 0.6 to 1.25. Aerodynamic loads were measured separately for each of the four canards and tail surfaces, and the total model. GRA

N75-33094* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE SKYLAB PARASOL
Jack A. Kinzler *In its* 9th Aerospace Mech. Symp. 1974 16 p (For availability see N75-33086 24-12)
CSCL 22B

N75-33102* Sperry Flight Systems, Phoenix, Ariz.
MAGNETICALLY SUSPENDED REACTION WHEELS
Ajit V. Sabnis, George L. Stocking, and Joe B. Dendy *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 28 p refs Prepared for JPL (For availability see N75-33086 24-12)
(Contract NAS7-100)
CSCL 22B

N75-33103* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Propulsion/Mechanical Dept.
USE OF COMPUTER MODELING TO INVESTIGATE A DYNAMIC INTERACTION PROBLEM IN THE SKYLAB TACS QUAD-VALVE PACKAGE
Raymond J. Hesser and Robert Gershman *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 13 p refs (For availability see N75-33086 24-12)
(Contract NAS9-6555)
CSCL 22B

N75-33129* Auburn Univ., Ala.
SPACE SHUTTLE
In its Econ. Analysis of Materials Processing in Space 15 Jun. 1975 p 8-39 refs (For availability see N75-33127 24-12)
CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N75-33169*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SUN DIRECTION DETECTION SYSTEM Patent Application
Louis F. Schmidt (JPL) and George D. Pace, Jr., inventors (to NASA) (JPL) Filed 24 Sep. 1975 24 p
(Contract NAS7-100)
(NASA-Case-NPO-13722-1; US-Patent-Appl-SN-616472) Avail: NTIS HC $3.25 CSCL 17G
A sun sensor detection system is described which includes an illumination detector and a sun angle detector. The illumination detector provides a low resistance output whenever the sun is within a selected field of view and a high resistance output whenever the sun is outside the field of view. The sun angle detector provides an output voltage related to the direction of the sun with respect to the normal direction. The output of the sun angle detector is fed to the attitude control circuitry to control the vehicle attitude with respect to the sun as a function of the output of the sun angle detector. NASA

N75-33170*# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
PLATED WIRE RANDOM ACCESS MEMORIES Final Report, Jun. 1974 - Jun. 1975

Lee D. Gouldin Jun. 1975 262 p
(Contract NAS5-20576)
(NASA-CR-144678; FR-4601-400) Avail: NTIS HC$6.25 CSCL 09B

A program was conducted to construct 4096-work by 18-bit random access, NDRO-plated wire memory units. The memory units were subjected to comprehensive functional and environmental tests at the end-item level to verify comformance with the specified requirements. A technical description of the unit is given, along with acceptance test data sheets. M.J.S.

N75-33089* Lockheed Missiles and Space Co., Sunnyvale, Calif.
STRUCTURAL EVALUATION OF DEPLOYABLE AERODYNAMIC SPIKE BOOMS
B. J. Richter *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 14 p ref (For availability see N75-33086 24-12)
CSCL 14B

N75-33096* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
REFURBISHMENT OF THE CRYOGENIC COOLERS FOR THE SKYLAB EARTH RESOURCES EXPERIMENT PACKAGE
Jerry C. Smithson and Norman C. Luksa *In its* 9th Aerospace Mech. Symp. 1974 17 p ref (For availability see N75-33086 24-12)
CSCL 14B

N75-33101* Santa Barbara Research Center, Goleta, Calif.
THE MECHANICAL DESIGN OF AN IMAGING PHOTOPOLARIMETER FOR THE JUPITER MISSIONS (PIONEER 10 AND 11)
James C. Kodak *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 12 p (For availability see N75-33086 24-12)
(Contract NAS2-5605)
CSCL 14B

N75-33118* IBM Federal Systems Div., Huntsville, Ala.
BOOST NAVIGATION AND GUIDANCE
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 9 p (For availability see N75-33114 24-12)
CSCL 17G

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N75-33171*# General Electric Co., Philadelphia, Pa. Space Div.
MULTI-KILOWATT MODULARIZED SPACECRAFT POWER PROCESSING SYSTEM DEVELOPMENT
R. E. Andrews, J. H. Hayden, R. T. Hedges, and D. W. Rehmann Jul. 1975 171 p refs
(Contract NAS3-17779)
(NASA-CR-134814; GE-SD-75SDS4242) Avail: NTIS HC $6.25 CSCL 22B

A review of existing information pertaining to spacecraft power processing systems and equipment was accomplished with a view towards applicability to the modularization of multi-kilowatt power processors. Power requirements for future spacecraft were determined from the NASA mission model-shuttle systems payload data study which provided the limits for modular power equipment capabilities. Three power processing systems were compared to evaluation criteria to select the system best suited for modularity. The shunt regulated direct energy transfer system was selected by this analysis for a conceptual design effort which produced equipment specifications, schematics, envelope drawings, and power module configurations. Author

N75-33172# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
AC POWER. GENERATION AND DISTRIBUTION Final Report
W. Denzinger Jan. 1975 107 p
(Contract ESTEC-1844/72-AA)
(ESRO-CR(P)-655) Avail: NTIS HC $5.25

Alternating current power generation and distribution of a square wave voltage in spacecraft was investigated; its feasibility was proved by development of a complete power conditioning system. An evaluation of electromagnetic interference of ac distribution was conducted. The requirements of the ac power conditioning system to be designed are derived from those of a geostationary spacecraft mission. A justification is given for the selected system, and a detailed description is included. ESA

N75-33173# Centre National d'Etudes Spatiales, Toulouse (France).
USER MANUAL FOR THE RITZ PROGRAM FOR THE DYNAMIC ANALYSIS OF LIQUID PROPELLANT ROCKETS [NOTICE D'UTILISATION DE RITZ, PROGRAMME D'ANALYSE DYNAMIQUE DE LANCEURS A LIQUIDE]
Nicolas Fernandez, Michel Fauveau, and M. Vedrenne Jun. 1975 97 p refs In FRENCH; ENGLISH summary
(CNES-NT-16) Avail: NTIS HC $4.75

A method is presented for computing longitudinal modes for launchers including stages with liquid propellants. The structure is described by simple axisymetrical elements which were used to formulate kinetic and elastic energies. Mass and stiffness matrices are connected using a finite element method; an original description of the liquid behavior is discussed. It was found that use of this program gave good results for the Diamant B P4 launcher. ESA

N75-33174# Centre National d'Etudes Spatiales, Toulouse (France).
DYNAMIC MODEL OF A CONTAINER COMPARTMENT WITH CAPILLARY RETENTION [MODELE DYNAMIQUE D'UN COMPARTIMENT DU RESERVOIR A CONTENTION CAPILLAIRE]
Paulette Dorio and Jean-Louis Marce Jul. 1975 52 p refs In FRENCH; ENGLISH summary
(CNES-NT-18) Avail: NTIS HC $4.25

The spin-stabilized satellite D5A is fitted with a spherical capillary tank provided with cylindrical grids. A mathematical model of the liquid-assumed nonviscous movement in a cylindrical compartment of this tank was established from a modal analysis. This equivalent model is shown to include only two modes coupled with the nutation. Author (ESA)

N75-33175# Royal Aircraft Establishment, Farnborough (England).
WORK IN UK ON THE APPLICATIONS OF SOLAR CELLS IN SPACE
F. C. Treble Dec. 1974 17 p Presented at the Intern. Solar Energy Soc. Conf., London, 6 Nov. 1974
(RAE-TR-74159; BR44998) Avail: NTIS HC $3.25

British effort and achievements in the field of photovoltaic solar energy conversion in space over the past 14 years are reviewed. The satellites powered by British solar cells are listed and the Ariel 3 array is described. Silicon cells of conventional thickness were developed to a conversion efficiency exceeding 11.5% and thin cells with a superior power-to-weight ratio were developed and manufactured in pilot production. Other achievements include a cheaper and better type of glass coverslip, an ultra-thin integral glass coating, and lightweight flexible cadmium sulfide cells. In anticipation of future multikilowatt power requirements, a prototype lightweight deployable array embodying advanced concepts was built and qualified for prolonged operation in the geostationary orbit. Author (ESRO)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N75-33176# California Univ., Los Angeles. Dept. of Chemistry.
SYNTHESIS OF DIAZONIUM DERIVATIVES OF B10H10(2-) FROM ARYLAZO INTERMEDIATES Interim Report
Richard N. Leyden and M. Frederick Hawthorne 15 May 1975 16 p refs
(Contract N00014-75-C-0301; NR Proj. 053-481)
(AD-A010581; TR-88; Contrib-3214) Avail: NTIS CSCL 07/3

Thermal decomposition of protonated arylazo derivatives of B10H10(2-) produce diazonium derivatives of B10H10(2-) plus the arene. A mechanism is suggested which involves electrophilic attack by a proton on the phenyl carbon atom bonded to the azo nitrogen atom. The general utility of this reaction is illustrated by the preparation of a variety of polyhedral B10(-) derivatives. GRA

N75-33177# Westinghouse Electric Corp., Bloomfield, N.J. Fluorescent and Vapor Lamp Div.
MATERIALS IDENTIFICATION AND CODING Final Report, 27 Apr. 1972 - 30 Apr. 1974
Frank M. Vodoklys Apr. 1974 103 p
(Contract DI-BM-HO-220049)
(PB-242487/7; BM-OFR-44-75) Avail: NTIS HC $5.25 CSCL 19A

The objective was to develop and evaluate materials and methods to achieve post-explosion identification of explosives reliably and economically through the use of phosphor-coded grains incorporated into the explosive during its manufacture. A coding system of two spotting phosphors and seven coding phosphors was successfully developed. The ability of the coded grains to survive detonation in many different types of explosives was demonstrated and the complete code was extracted from a single 100 micron post-explosion fragment. A laboratory method for manufacturing the coded grains was established and ten one-pound samples, each with a different code, were fabricated. A method was developed for applying a coating of polyethylene to the grains to prevent sensitization of the tagged explosives. GRA

N75-33178# Air Force Academy, Colo. Frank J. Seiler Research Lab.
THE SYNTHESIS OF TETRAAMINO ARYL ETHERS Final Technical Report, Jul. 1971 - Jun. 1974
Warren Villaescusa and John G. Breland, Jr. Jan. 1975 44 p refs
(AF Proj. 7903)
(AD-A010617; FJSRL-TR-75-0001) Avail: NTIS CSCL 07/3

A general synthesis for the bis(3,4-diaminophenoxy)aryl compounds has been developed. Nucleophilic substitution of 1,2-dinitro-4-fluorobenzene by the sodium salts of aromatic diols produce tetranitro aryl ethers. Catalytic reduction of these compounds in the presence of hydrazine give the corresponding tetrafunctional amines in good yields. Polymers using these oxyarylene-amines display both good thermal stability and increased solubility in aprotic solvents such as m-cresol. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N75-33179 Southern Methodist Univ., Dallas, Tex.
NEW MATERIAL MODELS FOR NONLINEAR MULTIMODULUS DEFORMATION OF ATJ-S GRAPHITE Ph.D. Thesis
Dudley Arthur Ray Nelson, Jr. 1975 246 p
Avail: Univ. Microfilms Order No. 75-21414

A material model for the nonlinear stress-strain behavior of artificial graphite under initial loading was developed in a somewhat unconventional but quite practical manner. This inherently simple model, based on a new deformation theory of orthotropic plasticity, was incorporated in a finite element computer program used in nosetip design. The new model is applicable to materials with nonlinear stress-strain curves of different shapes as well as to materials with plastic volume changes under load. The model is combined with two linear multimodulus material models developed within the last five years to obtain two different nonlinear multimodulus material models for orthotropic materials. These models are used to predict the uniaxial deformation behavior of ATJ-S graphite at room temperature when the load is applied at different orientations to the principal material directions. Favorable correlation between predicted and measured strains is found in biaxial tension. Dissert. Abstr.

N75-33180 Pennsylvania State Univ., University Park.
A CONTINUUM MICROSTRUCTURE THEORY FOR LAMINATED COMPOSITES Ph.D. Thesis
Bill Moustakakis 1975 212 p
Avail: Univ. Microfilms Order No. 75-22700

A continuum microstructure theory for symmetric laminated composites under in-plane loading is presented. The plane laminate problem is studied under conditions of plane strain and plane stress. Displacements are assumed in terms of seven global functions; the strain energy is written and the principle of stationary potential energy is used in the derivation of the differential equations and natural boundary conditions in each case. These equations are solved for the simple problems of angle-ply and bidirectional laminates under uniform axial extension. A two dimensional finite element, based on the theory, is derived for numerical solution of the problem in more complicated cases of loading and multiple material combinations. The results are compared to those obtained by a three dimensional finite element analysis. Dissert. Abstr.

N75-33181* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF MAKING AN INSULATION FOIL Patent
Edward A. Maslowski, inventor (to NASA) Issued 23 Sep. 1975 10 p Filed 2 May 1973 Supersedes N73-22415 (11 - 13, p 1532)
(NASA-Case-LEW-11484-1; US-Patent-3,906,769; US-Patent-Appl-SN-356554; US-Patent-Class-72-46; US-Patent-Class-117-38; US-Patent-Class-117-46FS; US-Patent-Class-117-105.2; US-Patent-Class-117-8.5; US-Patent-Class-29-527.2; US-Patent-Class-29-DIG.24; US-Patent-Class-29-DIG.39) Avail: US Patent Office CSCL 11D

An insulating foil particularly adapted for use in a multilayer insulation system is disclosed together with a method of making such insulation. A molten ceramic material such as a refractory oxide is deposited on a plurality of spots on a metal foil to produce protuberances having a ceramic coating. This may be accomplished by plasma spraying the material through an apertured mask placed against the foil. The foil may be in the form of a continuous strip which is advanced to a new position after each flame spraying operation. A cooled backing plate may be disposed against the foil to control the temperature thereof. Hydraulic actuating means may be utilized to actuate the apertured mask to clamp the foil between the mask and the backing plate prior to each flame spraying operation. Official Gazette of the U.S. Patent Office

N75-33182*# Los Alamos Scientific Lab., N.Mex.
CARBIDE COATED FIBERS IN GRAPHITE-ALUMINUM COMPOSITES Progress Report, 1 Aug. - 31 Dec. 1974
Richard J. Imprescia, Leonard S. Levinson, Robert D. Reiswig, Terry C. Wallace, and Joel M. Williams Washington NASA Oct. 1975 17 p refs
(NASA Order L-75900)
(NASA-CR-2601; LA-5908-PR; PR-3) Avail: NTIS HC $3.25 CSCL 11D

Thin, uniform coats of titanium carbide, deposited on graphite fibers by chemical vapor deposition with thicknesses up to approximately 0.1 microns were shown to improve fiber strength significantly. For greater thicknesses, strength was degraded. The coats promote wetting of the fibers and infiltration of the fiber yarns with aluminum alloys, and act as protective barriers to inhibit reaction between the fibers and the alloys. Chemical vapor deposition was used to produce silicon carbide coats on graphite fibers. In general, the coats were nonuniform and were characterized by numerous surface irregularities. Despite these irregularities, infiltration of these fibers with aluminum alloys was good. Small graphite-aluminum composite samples were produced by vacuum hot-pressing of aluminum-infiltrated graphite yarn at temperatures above the metal liquidus. Author

N75-33183*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
JOINING AND FABRICATION OF METAL-MATRIX COMPOSITE MATERIALS
Dick M. Royster, H. Ross Wiant (LTV Aerospace Corp.), and Thomas T. Bales Washington Oct. 1975 24 p
(NASA-TM-X-3282; L-10357) Avail: NTIS HC $3.25 CSCL 11D

Manufacturing technology associated with developing fabrication processes to incorporate metal-matrix composites into flight hardware is studied. The joining of composite to itself and to titanium by innovative brazing, diffusion bonding, and adhesive bonding is examined. The effects of the fabrication processes on the material properties and their influence on the design of YF-12 wing panels are discussed. Author

N75-33184# Sandia Labs., Albuquerque, N.Mex.
CRACK INITIATION IN B-AL COMPOSITES
W. R. Hoover May 1975 23 p refs
(Contract AT(29-1)-789)
(SAND-74-0323) Avail: NTIS HC $4.25

The toughness of notched, unidirectional B-Al composite under 3-point bending was examined as a function of filament volume fraction, filament diameter, and matrix yield strength. The results illustrate that the work-of-fracture, gamma sub f, criterion for composite toughness has only limited utility since gamma sub f was found to be a strong function of notch length. The linear, elastic fracture toughness, K sub c, was observed to be independent of both notch length and filament diameter. The K sub c values increased significantly as the yield strength of the matrix increased. The critical energy release rate, L sub c, was shown to be independent of crack length, filament diameter, and matrix yield strength. It was proposed that L sub c is a reflection of the strain energy stored in the filaments at crack initiation and is thus a measure of the parameter which controls composite crack initiation--strain in the filaments at the notch root. Author (NSA)

N75-33185# California Univ., La Jolla. Dept. of Applied Physics and Information Science.
NEW MATERIALS BY LOW TEMPERATURE CONDENSATION Final Report
H. L. Luo 15 Mar. 1975 12 p refs
(Contract AT(04-3)-34)
(UCSD-34P162-6) Avail: NTIS HC $4.00

Activities in research programs are reported on superconductivity, magnetism, amorphous materials, and surface coating. The superconductivity studies are concerned with materials having high critical temperatures and high critical fields. Contributions were made towards the understanding of magnetic properties of ZrZn2 and Cu-Ni. The low-temperature specific heat and crystallization properties of amorphous materials were studied along with the mechanical strength of surface layers of carbon on V, Nb, Ta, Mo, and W. NSA

N75-33186# Transit Development Corp., Washington, D.C.
SMOKELESS CABLE Final Report
John Mombach and William M. Connell Jun. 1974 12 p refs
(PB-241850/7; TDC/500-74/2) Avail: NTIS HC $3.25 CSCL 13L

The transit industry embarked upon a program to realistically and comprehensively develop an understanding of fire safety in the use of electrical wire and cable insulations and jacketing materials. The New York City Transit Authority devoted time and effort to identify the potential dangers. The fire safety problem concerned with excessive heat characteristics is described. GRA

N75-33187# McDonnell Aircraft Co., St. Louis, Mo.
ELECTROMAGNETIC EFFECTS OF ADVANCED COMPOSITES Final Report, 1 May - 31 Dec. 1974
C. D. Skouby Jan. 1975 113 p refs
(Contract N00014-74-C-0200; NR Proj. 213-121)
(AD-A010882) Avail: NTIS CSCL 11/4

The investigation consisted of an evaluation of the effectiveness of boron and graphite composites as electromagnetic shields and as antenna ground planes. Emphasis was given to the determination of their performance relative to that of metal. GRA

N75-33188# Princeton Univ., N.J. Dept. of Civil and Geological Engineering.
A TWO-DIMENSIONAL LATTICE MODEL FOR COMPOSITES REINFORCED WITH ORTHOGONAL FIBERS
H. Demiray, A. C. Eringen, and M. N. L. Narasimhan May 1975 27 p refs
(Contract N00014-67-A-0151-0004; NR Proj. 064-410)
(AD-A011095; TR-38; RR-75-SM-8) Avail: NTIS CSCL 11/4

A two-dimensional lattice dynamics model for a composite reinforced with two sets of orthogonally interlocking fibers is given, and the propagation of plane harmonic waves in such a medium is investigated. The composite considered consists of two sets of orthogonal equivalent elastic fibers and a matrix material whose elastic properties are different from those of the fibers. The dispersion relations of waves propagating in the medium are studied and various special cases are investigated. GRA

N75-33189# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
CHARACTERIZATION OF GRAPHITE FLUORIDE, (CFx)n, AS A POTENTIAL SOLID LUBRICANT MATERIAL Final Technical Report, Jan. 1972 - Jan. 1974
B. D. McConnel, C. E. Snyder, and J. R. Strang Mar. 1975 70 p refs
(AF Proj. 7343)
(AD-A010724; AFML-TR-74-35) Avail: NTIS CSCL 11/8

Graphite Fluoride (CFx)n, from several sources, has been analyzed and evaluated for its friction, wear, and lubrication behavior. Pressed pellets, burnished films, and bonded films of (CFx)n has been compared to similar specimens of MoS2 in several test devices at room temperature conditions. Although the various (CFx)n materials have been shown to vary in chemical composition, color, impurity levels, and thermal stability, no significant difference in lubrication performance has been observed between these materials in the lubricant test devices. In general, (CFx)n has been found to be inferior to MoS2 in its lubrication behavior in the more severe test environments. Therefore, (CFx)n is not considered to be suitable for use as a solid lubricant in Air Force aircraft and weapon systems having heavy load lubrication requirements. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N75-33190 Princeton Univ., N.J.
MOLECULAR BEAM ANALYSIS INVESTIGATION OF THE REACTIONS OF SOME GASES IN WEAK RADIO-FREQUENCY DISCHARGES Ph.D. Thesis
Barry Lee Hertzler 1974 185 p
Avail: Univ. Microfilms Order No. 75-23209

The reactions of some gases as they rapidly flowed through a low powered, electrodeless 28.9 MHz discharge were investigated by the technique called molecular beam analysis (MBA), which combines mass spectrometry with prior separation of the neutrals in a molecular beam. The molecular beam is defined as those molecules that are traveling in a direction which allows them to pass through a series of holes in the walls separating the vacuum chambers that lead to the mass spectrometric detector. The paramagnetic radicals are separated from the diamagnetic molecules in the molecular beam by being deflected by a magnetic field. The first gases studied were hydrocarbons. In each case, reactions occurred when these gases were passed through the plasmas, but no radicals were observed. Most of the investigations were done with fluorocarbon reactants. An appreciable amount of trifluoromethyl radicals were found in hexafluoroacetone plasmas. Dissert. Abstr.

N75-33191 Michigan Univ., Ann Arbor.
SOME INTERESTING NEW DIRECTIONS IN LIGHT BEATING SPECTROSCOPY Ph.D. Thesis
Mark Sender Slutsky 1975 234 p
Avail: Univ. Microfilms Order No. 75-20451

The possibility of using ordinary, incoherent light sources as the primary sources of electromagnetic radiation for light beating spectroscopic techniques was investigated. A classical stochastic model of the electric field produced by a thermal light source is first presented. The production of a beat frequency in the output of a square-law detector illuminated by such a source may originate either by the interference of light from a pair of distinct atoms or by the interference of light from a single atom with itself. The second mechanism dominates in the quantum limits of low intensity and short wavelength. A full quantum mechanical theory of both source and detector was performed to study the role of the single atom terms. It follows that suitably prepared atomic beams, as well as certain radioactively prepared samples, may be used as sources for light beating spectroscopy.
Dissert. Abstr.

N75-33192*# Scientific Translation Service, Santa Barbara, Calif.
GEL PERMEATION CHROMATOGRAPHY AND ITS APPLICATION TO PETROLEUM ANALYSIS
Minoru Fujita and Mineko Kumamoto Washington NASA Oct. 1975 18 p refs Transl. into ENGLISH from Sekiyu Gakkai Shi (Japan), v. 15, no. 9, Sep. 1972 p 747-752
(Contract NASw-2791)
(NASA-TT-F-16627) Avail: NTIS HC $3.25 CSCL 07D

General principles of gel permeation chromatography are described. It is concluded that it will be a useful way to determine molecular weight distribution and to separate components.
Author

N75-33193*# Georgia Inst. of Tech., Atlanta.
A SIMPLE REACTION-RATE MODEL FOR TURBULENT DIFFUSION FLAMES
Louis H. Bangert [1975] 29 p refs
(Grant NGR-11-002-177)
(NASA-CR-119106) Avail: NTIS HC $3.75 CSCL 21B

A simple reaction rate model is proposed for turbulent diffusion flames in which the reaction rate is proportional to the turbulence mixing rate. The reaction rate is also dependent on the mean mass fraction and the mean square fluctuation of mass fraction of each reactant. Calculations are compared with experimental data and are generally successful in predicting the measured quantities.
Author

N75-33194# Brookhaven National Lab., Upton, N.Y.
TRITIUM STORAGE DEVELOPMENT Progress Report, Oct. - Dec. 1974
Jan. 1975 30 p Sponsored by ERDA
(BNL-19688; PR-2) Avail: NTIS HC $4.50

Work is reported on the development of tritium fixation in cement concrete, polymer-impregnated concrete, and conversion to highly stable organic compounds. The scope of the work is to develop formulations and to evaluate the chemically and physically stable solid forms for long term storage. The selection of hydraulic cement was based on its ability to react with water, its noncorrosive nature, its ability to be formed into any shape at normal temperature, and its ability to withstand heat and flame. Another important factor is availability in all parts of the country at reasonable prices. The techniques developed at Brookhaven National Laboratory for impregnating hardened concrete with polymer will be applied to further enhance the integrity and watertightness of tritiated concrete. The fixation of tritium in highly stable polymeric materials has an advantage in that the carbon-hydrogen bonds are highly covalent. This should result in a very low hydrogen exchange rate. Author (NSA)

N75-33195# Interuniversitair Reactor Instituut, Delft (Netherlands).
THE MEASUREMENT OF POLYDISPERSE AEROSOLS WITH THE SPIRAL CENTRIFUGE
G. A. Ferron and H. W. J. Bierhuizen Feb. 1975 44 p refs
(IRI-190-75-03) Avail: NTIS HC $3.75

Some characteristics for measurement according to the aerodynamic size of the particle by means of the spiral centrifuge designed by Stober are presented. Coordinates were established, and the centrifuge was calibrated with monodisperse latex aerosols for fixed conditions. The calculations to obtain the mass distribution of the aerosol sampled with the centrifuge and measured with the method described were conducted by a computer program written in FORTRAN 4. ESA

N75-33196# Bureau of Mines, Laramie, Wyo. Energy Research Center.
PROCESSING HIGH-RESOLUTION MASS SPECTROGRAPHIC PLATES WITH A COMPARATOR-MICRODENSITOMETER-PROGRAMMABLE CALCULATOR SYSTEM
J. H. Weber, D. G. Earnshaw, D. W. K. Severin, and A. W. Decora Dec. 1974 19 p refs
(PB-241880/4; BM-RI-7938) Avail: NTIS HC $3.25 CSCL 07D

The hardware system and software package for the semiautomatic acquisition and automatic processing of high-resolution mass spectrographic plates is described. The semiautomatic data acquisition system allows a tenfold saving of time as compared to manual data acquisition. The processing technique described is particularly adaptable to small laboratories having budgets that preclude access to more sophisticated data processors. Automatic processing of the high-resolution data to yield exact masses, intensity, and the corresponding empirical formulas is accomplished by efficient programming on a small, inexpensive, programmable calculator system. GRA

N75-33197# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
CONTINUOUS MONITORING OF TOTAL DISSOLVED GASES IN NATURAL WATERS, A FEASIBILITY STUDY
Thomas F. Jenkins May 1975 14 p refs
(AD-A011248; CRREL-SR-231) Avail: NTIS CSCL 14/2

A preliminary investigation was undertaken to determine if a monitoring device capable of unattended operation could be configured to continuously measure total dissolved gases in natural waters. A three-component system was designed consisting of a pumping system, a continuous gas stripper, and a detector. Prototypes of the first two components were assembled and evaluated under field conditions. Based upon these results, it is possible to configure a monitor capable of unattended operation for continuous measurement of total dissolved gas concentrations in natural waters. GRA

N75-33198# National Standard Reference Data System.
THE RADIOLYSIS OF METHANOL: PRODUCT YIELDS, RATE CONSTANTS, AND SPECTROSCOPIC PARAMETERS OF INTERMEDIATES
J. H. Baxendale and Peter Wardman Apr. 1975 34 p refs Prepared in cooperation with Manchester Coll. of Sci. and Tech. and Mount Vernon Hosp., Northwood, Engl.
(COM-75-10625/2; NSRDS-NBS-54; LC-74-19001) Avail: NTIS HC $3.75; also avail. from SOD as C13.48:54 CSCL 07E

Product yields and primary yields in the radiolysis of methanol in the solid, liquid and vapor phase were compiled and reviewed. Preferred values for G of the major products in the vapor and liquid states are listed. Rates of reactions of solvated and trapped electrons and other transient ions and radicals, and optical absorption and ESR parameters for solvated and trapped electrons, CH_2OH, and CH_3O are also included. GRA

N75-33199# National Standard Reference Data System.
SELECTED SPECIFIC RATES OF REACTIONS OF TRANSIENTS FROM WATER IN AQUEOUS SOLUTION. 2: HYDROGEN ATOM
Michael Anbar, Farhataziz Ross, and Alberta B. Ross May 1975 63 p refs Prepared in cooperation with Stanford Res. Inst., Menlo Park, Calif. and Notre Dame Univ.
(COM-75-10617/9; NSRDS-NBS-51; LC-73-600329) Avail: NTIS HC $4.25; also avail from SOD as C13.48:51 CSCL 07B

Rates of reactions of hydrogen atoms (from radiolysis of water and other sources) with organic and inorganic molecules, ions, and transients in aqueous solution were tabulated. Directly measured rates obtained by kinetic spectroscopy or conductimetric

methods, and relative rates determined by competition kinetics are included. GRA

N75-33200# Southampton Univ. (England). Dept. of Chemistry.
EMISSION SPECTRA KINETICS Final Report, 1 Feb. 1972 - 31 Oct. 1974
Neville Jonathan Apr. 1975 14 p refs
(Grant AF-AFOSR-2276-72; AF Proj. 3326)
(AD-A010467; AFCRL-TR-75-0287) Avail: NTIS CSCL 07/4

The work carried out under this project has been in two separate areas: the dynamics of simple atom molecule reactions yielding hydrogen fluoride as studied by infra-red chemiluminescence, and the use of vacuum ultraviolet photoelectron spectroscopy to detect and characterize gaseous free radicals, electronically excited molecules and vibrationally excited species. Results are briefly discussed. GRA

N75-33201# Texas Univ., Austin. Dept. of Chemistry.
SCF-X ALPHA-SW CALCULATION OF ELECTRONIC ENERGY LEVELS FOR METHANOL ADSORBED ON ALUMINA Technical Report, 1 May 1974 - 30 Apr. 1975
David C. Foyt and J. M. White 26 May 1975 15 p refs
(Contract N00014-67-A-0126-0021; NR Proj. 056-578)
(AD-A010540; TR-75-01) Avail: NTIS CSCL 07/4

The calculation of vertical ionization potentials is reported for methanol, Al_2O_3, and a model CH_3O Al_2O_3 system representing the surface adsorbate-substrate complex. The SCF-X alpha-SW technique was employed, and the orbital energies were obtained by means of the transition state method. The feasibility of using such calculations in the interpretation of UPS spectra for the methanol-alumina system is also discussed. GRA

N75-33202# Transit Development Corp., Washington, D.C.
TRANSIT FLAMMABILITY REQUIREMENTS Final Report
Eugene Schafran Jun. 1974 11 p refs
(PB-241851/5; TDC/500-74/3) Avail: NTIS HC $3.25 CSCL 13L

Control of the flammability characteristics of furnishings within a structure will reduce the fire hazard to the structure and enhance the life safety of its occupants. Flammability of materials should be considered along with comfort, cost, and wear. Quantifying flammability, setting acceptable standards, identifying appropriate test procedures, and locating the material to satisfy the standards are steps taken by the Port Authority of New York and New Jersey. GRA

N75-33203# California Univ., Berkeley. Dept. of Mechanical Engineering.
POLYMER FLAME RETARDANT MECHANISMS
D. J. Holve and R. F. Sawyer Feb. 1975 34 p refs
(Contract C-5-9003)
(COM-75-10696/3; ME-75-2; NBS-GCR-75-40) Avail: NTIS HC $3.75 CSCL 21B

An opposed flow diffusion flame technique was used to measure steady state burning rates and extinction velocities for several polymers (with and without added flame retardants) at varying oxygen concentrations in the oxidizing stream. From these results and an analysis based on extinction Damkohler numbers, overall gas phase activation energies and effective mass transfer numbers were derived. Preliminary findings for flame retarded PMMA show that while flame stability is reduced, (i.e., it takes a higher oxygen concentration to sustain combustion) the burning rate increases. In another case for particle board, boric acid flame retardant is found to reduce the burning rate, but not to have any substantial effect on flame stability. These results suggest that both types of retardants are necessary for effective flammability reduction. GRA

N75-33204# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
TABLES OF SPECTRAL-LINE INTENSITIES. PART 2: ARRANGED BY WAVELENGTHS. SECOND EDITION
William F. Meggers, Charles H. Corliss, and Bourdon F. Scribner May 1975 228 p refs Supersedes NBS-Mono-32-Pt-2
(COM-75-10756/5; NBS-MN-145-Pt-2; LC-74-16256; NBS-Mono-32-Pt-2) Avail: NTIS HC $7.50; SOD HC also available as C13.44:145/2 CSCL 07D

The relative intensities of radiant powers, of 39,000 spectral lines with wavelengths between 2000 and 9000 Angstroms determined on a uniform energy scale for seventy chemical elements are given in order of wavelength. Author

N75-33205# Council for Scientific and Industrial Research, Pretoria (South Africa). Chemical Engineering Research Group.
THE DIFFUSION COEFFICIENT OF FERRICYANIDE IN AQUEOUS POTASSIUM CHLORIDE SOLUTIONS WITH AND WITHOUT POLYETHYLENE OXIDE
J. J. V. D. Graaf Feb. 1975 43 p refs
(PB-242492/7; CSIR-CENG-068; ISBN-0-7988-0650-8) Avail: NTIS HC $3.75 CSCL 07D

The diffusion coefficient of the ferricyanide ion was determined in the temperature range 20-35C in equimolar solutions of ferri- and ferro-cyanide (.005M) with potassium chloride (0.5; 1.0; 2.0 M) as a carrier electrolyte and with and without polyethylene oxide (0; 50; 100 ppm). The methods used were mass transfer on a rotating disk electrode and chronoamperometry in a linear diffusion cell. Density and viscosity data on the solutions are given. GRA

N75-33206# British Steel Corp., London (England).
THE COULOMETRIC DETERMINATION OF SULFUR IN STEEL
H. J. Boniface and R. H. Jenkins Mar. 1975 8 p refs
(PB-242501/5; BISRA-SM/235/A) Avail: NTIS HC $3.25 CSCL 07D

A method is described for the precise determination of sulphur in steel. Oxides of sulphur evolved from steel under the IRSID conditions (Pontet and Boulin) are absorbed in aqueous medium and titrated coulometrically. The coulometric procedure can be automated, but is intended here to provide a reference method. Reproducibility index was found to be 0.0016%S at the 0.05%S level. GRA

N75-33207# British Steel Corp., London (England).
A METHOD FOR THE SPECTROGRAPHIC ANALYSIS OF SMALL AMOUNTS OF NON-METALLIC STEELWORKS MATERIALS
A. Hodkinson Mar. 1975 8 p refs
(PB-242502/3; BISRA-SM/589/A) Avail: NTIS HC $3.25 CSCL 07D

A published method for the quantitative analysis of a wide variety of materials by emission spectrometry has been modified to suit the Hilger Large Quartz Spectrograph. The technique, which has been developed for determining 19 elements in milligram amounts of corrosion deposits, dusts, water residues and other miscellaneous materials, is described. Examples of its application are appended. GRA

N75-33208# British Steel Corp., London (England).
THE COULOMETRIC DETERMINATION OF CARBON IN STEEL
H. J. Boniface and R. H. Jenkins Mar. 1975 15 p refs
(PB-242503/1; BISRA-SM/155/A) Avail: NTIS HC $3.25 CSCL 07D

A method suitable for referee analysis is developed for the precise determination of carbon in steel. It employs coulometric titration of carbon dioxide absorbed in an almost non-aqueous medium. The apparatus is inexpensive and the procedure is simple. Suggestions are made for automating the technique to provide a rapid routine method of high precision. The analytical performance of the recommended method compares well with that of low pressure volumetric methods. Standard deviations of 0.00035% at the 0.05%C level to 0.004% at the 1% carbon level are obtained. GRA

N75-33209# California Univ., Berkeley. Fire Research Group.
COMPF: A PROGRAM FOR CALCULATING POST-FLASHOVER FIRE TEMPERATURES
Vytenis Babrauskas Jan. 1975 58 p refs Sponsored in part by HUD and NBS
(Grant NSF GI-43)
(PB-242346/5; UCB-FRG-75-2; NSF/RA/E-75-022) Avail: NTIS HC $4.25 CSCL 13L

COMPF is a computer program for calculating gas tempera-

tures in a compartment during the post-flashover period of a fire. It is intended both for performing design calculations and for facilitating further research in endurance requirements for fire-resistive building assemblies. In addition to the capability of performing calculations for a compartment with completely determined properties, routines are included for calculating the fire behavior under certain worst expected conditions. A comprehensive output format is provided which gives gas temperatures, heat flow terms, and properties of the fire gases. The report includes input instructions, sample problems, and a listing of the program. GRA

N75-33210# American Univ., Washington, D.C. Dept. of Chemistry.
COMPLEX IONS AND CORROSION
R. T. Foley Jun. 1975 11 p refs
(Contract N00014-68-A-0245-0009; NR Proj. 036-106)
(AD-A011099; TR-1) Avail: NTIS CSCL 07/4

Environmental effects have been largely ignored in the development of corrosion mechanisms and concepts related to the passivity of metals and alloys. In the development of passivity mechanisms, including the formation of passive films, the composition of the electrolyte has been given virtually no consideration except in so far as it provides protons and hydroxyl ions. Yet the breakdown of passivity is often tied to specific ion adsorption and the chloride ion is attributed with unique properties that are evident for this ion in no other area of chemistry. The purpose of this communication is to reexamine the role of environmental effects, specifically anion effects, with the view of establishing a concept that will be a useful and guiding principle describing the influence of anions in corrosion and passivity. GRA

N75-33211# Utah Univ., Salt Lake City. Dept. of Chemistry.
BRILLOUIN-RAYLEIGH SCATTERING STUDIES OF POLYPROPYLENE GLYCOL, 2
C. H. Wang and Y. Y. Huang 2 Jun. 1975 27 p refs
(Contract N00014-75-C-0908; NR Proj. 051-562)
(AD-A010883; TR-8) Avail: NTIS CSCL 07/4

A comprehensive Brillouin scattering experimental study of polypropylene glycol (PPG), average molecular weight of 1025, 2025 and 4000, has been carried out. The hypersonic velocity, attenuation coefficient, the modulus of elasticity and the Landau-Placzek ratio have been obtained as a function of temperature for each polymer. The PPG 425 data reported earlier are also included for comparison. For all the quantities measured, only the Landau-Placzek ratio (below ambient temperature) is molecular weight dependent, the hypersonic velocity, attenuation coefficient and elastic modulus are found to be independent of molecular weight in the present 425-4000 weight range. The differences in the Landau-Placzek ratio between the different polymers are attributed to different degree of frozen-in density fluctuations due to the difference in the medium's vicosity; the mechanism of structural relaxation is not sufficient to explain the increase of the Landau-Placzek ratio of each polymer below ambient temperature. The present results on the sound velocity and attenuation can be satisfactorily fit to a theory developed by Isakovich and Chaban, who have modeled the highly viscous liquid as a microinhomogeneous medium. GRA

N75-33212# Sussex Univ., Brighton (England).
THE INFLUENCE OF SUBSTITUTION ON THE FORMATION OF EXCITED SINGLET STATES FROM THE DECOMPOSITION OF DIOXETANES Final Technical Report
Frank McCapra, Chris Zaklika, and John Gilmore Apr. 1975 31 p refs
(Contract DAJA37-74-C-1209)
(AD-A011031) Avail: NTIS CSCL 07/4

This work was designed to discover whether changes in substitution in dioxetanes would alter the rates of decomposition and the proportion of excited singlet products formed. Thirteen dioxetanes were synthesised and their decomposition studied by monitoring the light emission which accompanied the formation of carbonyl products. It was found that substitution did indeed affect the rate of decomposition, and in the dioxetane derived from benzylidene acridan, remarkably high yields of singlet excited states were obtained. However, it was extremely difficult to produce consistent results, and it was shown that the difficulties were not due to induced decomposition or transition metal catalysis. A very thorough investigation of the effect of solvent was undertaken, incidentally establishing the reliability of the central observations. Highly electron-donating substituents increase the rate of decomposition and that this rate enhancement is accompanied, in one case in particular, by excited singlet yields of about 30%. GRA

N75-33213# Naval Ship Research and Development Center, Bethesda, Md.
DETERMINING THE CONCENTRATION OF OIL IN WATER SAMPLES BY INFRARED SPECTROPHOTOMETRY. PHASE 1: SAMPLE AGING STUDY
Stanley Finger, Harry Feingold, Ed. Timko, and Sidney Orbach (Bradford Computer and Systems, Inc.) Dec. 1974 113 p refs
(Contract N00600-72-D-0613)
(AD-A011040; NSRDC-4535) Avail: NTIS CSCL 07/3

Oil in water samples of Naval Distillate Fuel Oil (NDFO) and Steam Turbine Lubricating Oil (MS 2190 TEP) at concentrations of 16 p/m and 100 p/m were studied to determine and quantify aging due to various types of degradation with time, under normal storage conditions. The samples were prepared individually from synthetic sea water and a quantity of oil which gave the desired concentration. The samples were analyzed at several intervals during an eight-week aging period. Oil concentration was determined by a method which is based on carbon tetrachloride solvent extraction and the infrared spectrophotometric measurements of the extract. Calibration curves relating the absorbance with oil concentration for the two oils were prepared from a measured quantity of oil in carbon tetrachloride. The purpose of the sample aging study was to obtain information for use in scheduling sample shipment and analysis in a forthcoming inter-laboratory study of the oil concentration measurement technique, as well as to estimate the allowable delay in sample analysis after field sampling. GRA

N75-33214# Defence Research Establishment Ottawa (Ontario).
THE KINETICS OF THE Pb SO4/PbO2 ELECTRODE AT LOW TEMPERATURES
Eugene M. L. Valeriote and Lloyd D. Gallop Apr. 1975 26 p refs Presented at the Intern. Power Sources Symp., 9th, Brighton, England, Sep. 1974
(AD-A011028; DREO-R-717) Avail: NTIS CSCL 07/4

Direct and alternating current potentiostatic and potentiodynamic measurements were applied to the study of lead dioxide formation in sulphuric acid at temperatures from -50C to 0C. The initial oxidation reaction kinetics were found to be controlled by two dimensional nucleation and growth, followed by diffusion through the completed surface layer. From the model and derived results, the heights of the nuclei were determined as a function of temperature and applied potential from both the linear scan voltammetry and potential-step methods, the diffusion parameters of the rate controlling step were obtained. These results permit an improved description of the sequential anodic oxidation processes. GRA

N75-33215# Idaho Univ., Moscow. Dept. of Chemistry.
NEW HYPOFLUORITES CONTAINING NITROGEN Final Technical Report, 1 Apr. 1971 - 31 Dec. 1974
Jeanne M. Shreeve 3 Jun. 1975 17 p refs
(Contract N00014-71-C-0153; NR Proj. 093-040)
(AD-A011109) Avail: NTIS CSCL 07/3

The report summarizes research activities in fluorine chemistry. Synthesis and reactions of a wide range of novel fluorides and organic fluorine compounds are reported. A list of publications from the 45 month contract is included. GRA

N75-33216# Aerospace Corp., El Segundo, Calif. Lab. Operations.
CONFIGURATION INTERACTION STUDIES OF THE EXCITED STATES OF WATER Interim Report
Nicholas W. Winter, William A. Goddard, III (Calif. Inst. of Tech.), and Frank W. Bobrowicz (Calif. Inst. of Tech.) 15 Apr. 1975 31 p refs
(Contract F04701-74-C-0075)
(AD-A010599; TR-0075(9270-01)-6; SAMSO-TR-75-129) Avail: NTIS CSCL 07/4

The results of extensive configuration interaction studies of 16 excited states of water are reported. These states can be accurately described as corresponding to excitation from one of the highest two molecular orbitals (1b1 or 3a1) of the ground state into either the 3s or one of the three 3p Rydberg orbitals. The results provide the most accurate and consistent treatment of these states of date (within 0.1 eV for all known transitions) form a reliable basis for the assignment of the photon and electron impact spectra of H2O. GRA

N75-33217# IBM Watson Research Center, Yorktown Heights, N.Y.
ORDERED ORGANIC SYSTEMS AND MOLECULAR RECTIFIERS Quarterly Report, 1 Jan. - 31 Mar. 1975
B. A. Scott 31 Mar. 1975 10 p refs
(Contract DAHC04-75-C-0010; ARPA Order 2870)
(AD-A010555; QR-1) Avail: NTIS CSCL 07/4

The major effort of this research program is the fabrication and study of organic and organo-metallic molecular arrays in thin film form. The films are prepared by the Langmuir-Blodgett technique, which permits the deposition of one or two monolayers at a time. Specifically, the authors have developed the necessary techniques to deposit layers of fatty acids and their salts by this method and are engaged in the determination of their structural and magnetic parameters. The intent of these studies is to enable the construction of two-dimensional arrays whose structures are completely characterized, and to use this knowledge in fabricating two-dimensional magnetic arrays to test various models of magnetic ordering. In addition, an ambitious synthetic organic program is underway with the aim of synthesizing a molecule with asymmetric electron tunneling characteristics. It is planned to create monolayers of such molecular rectifiers using the Langmuir-Blodgett technique and to study their electrical characteristics. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N75-33218 Rice Univ., Houston, Tex.
THE ELECTROTRANSPORT OF HYDROGEN IN PALLADIUM Ph.D. Thesis
Richard Bowen Loftin 1975 138 p refs
Avail: Univ. Microfilms Order No. 75-22033

The transport velocity of hydrogen in a palladium wire under the influence of an applied electric field has been measured by an electrochemical technique at room temperature and at liquid-nitrogen temperature. One end of the wire was electrolytically charged with hydrogen from a solution of hydrochloric acid. At the other end hydrogen was electrolytically removed from the palladium. The accumulation of hydrogen ions in the solution was measured as a function of time, and a transport velocity was determined. With the entire wire at room temperature a transport velocity of 0.00039 + or - 0.00021 moles H/sec was obtained for a current of 0.01 A. The transport velocity measured with a portion of the wire at 77 K was of the same order of magnitude as that measured with the entire wire at room temperature. Dissert. Abstr.

N75-33219 Princeton Univ., N.J.
SPECTROSCOPY OF TRANSITION METAL IONS IN CRYSTALS Ph.D. Thesis
Arthur Elliott Salwin 1975 129 p
Avail: Univ. Microfilms Order No. 75-23237

Symmetry, physical, and mathematical arguments are given to explain why a magnetic field induces dichroism in a sample, and new expressions are derived for analyzing liquid helium temperature MCD spectra. The MCD is used to detect ground state EPR resonances in a microwave - optical double resonance apparatus which was designed and constructed for that purpose. A double resonance study was made of the d-d transitions in Al2O3:Cr3+. Using this technique, a microwave induced cross relaxation process was observed. In ZnS:Mn(2+) the controversy regarding the E(4) band was settled. By filtering out pair transitions, MCD showed that the structure is vibronic with an underlying absorption due to pairs. In addition, the 4300A band was unambiguously assigned for the first time. Heat treatment, ultraviolet irradiation, and EPR were used to confirm or refute the assignments of the recently discovered high energy bands in KMgF3 doped with transition metal ions. Dissert. Abstr.

N75-33220 Tulane Univ., New Orleans, La.
ELECTRON DIFFRACTION INTENSITIES OF SINGLE CRYSTALLINE GOLD THIN FILMS Ph.D. Thesis
Joseph Da-Cheng Peng 1975 89 p
Avail: Univ. Microfilms Order No. 75-23292

An investigation was conducted whose primary objectives were to grow a series of thin gold films, obtain electron diffraction patterns, and to compare the measured relative intensities with those calculated using dynamical electron diffraction theory. Gold films of (111) orientation and of thicknesses from 60A to 1000A were grown by vacuum evaporation on oriented silver substrates. By altering the evaporation parameters, gold films were obtained which were relatively free of lattice defects. The structure of each film was carefully examined using transmission electron microscopy and surface replication techniques. The conventional parallel beam method was employed to obtain cross-grating electron diffraction patterns. Relative intensities were recorded using both a photographic method and by directly measuring electron current densities. The effect of specimen contamination on relative intensities was studied by intentionally subjecting the thin films to different degrees of surface contamination. The effect of thermal diffuse scattering on relative intensities was examined by making measurements at different film temperatures. Dissert. Abstr.

N75-33221 Case Western Reserve Univ., Cleveland, Ohio.
THE EFFECT OF IMPURITIES ON INTRINSIC STRESS IN THIN NICKEL FILMS Ph.D. Thesis
Pierre Martin Alexander 1975 97 p
Avail: Univ. Microfilms Order No. 75-19182

Intrinsic stresses in thin nickel films vapor deposited in ultrahigh vacuum (UHV) on nickel substrates were investigated. The cantilevered beam technique was used for measuring the film force per unit width as a function of film thickness. A new method, based on single slit diffraction, was developed for observing the substrate deflection. The stresses are tensile and the average values decrease as the percentage of impurities increases. The film impurity concentrations, determined from Auger electron spectroscopy depth profile data, show a similar correlation with the instantaneous stresses as a function of film thickness. The source of the impurities was determined to be the evaporation filament. The results are interpreted in terms of the grain boundary model, which is presented in an interfacial energy formulation. The stresses depend on free surface and grain boundary energies which are reduced by impurity concentrations, and oxygen is believed to play the predominant role. Dissert. Abstr.

N75-33222*# Alabama Univ., Huntsville. School of Graduate Studies and Research.
SUPERCONDUCTING COMPOUNDS AND ALLOYS RESEARCH Interim Report, 1 Jul. 1971 - 31 May 1973
Guenther Otto Jun. 1975 110 p refs
(Contract NAS8-27809)
(NASA-CR-143966; UAH-RR-174) Avail: NTIS HC $5.25 CSCL 11F

Resistivity measurements as a function of temperature were performed on alloys of the binary material system In sub(1-x) Bi sub x for x varying between 0 and 1. It was found that for all single-phase alloys (the pure elements, alpha-In, and the three intermetallic compounds) at temperatures sufficiently above the Debye-temperature, the resistivity p can be expressed as p = a sub o T(n), where a sub o and n are composition-dependent constants. The same exponential relationship can also be applied for the sub-system In-In2Bi, when the two phases are in compositional equilibrium. Superconductivity measurements on single and two-phase alloys can be explained with respect to the phase diagram. There occur three superconducting phases (alpha-In, In2Bi, and In5Bi3) with different transition temperatures in the alloying system. The magnitude of the transition temperatures for the various intermetallic phases of In-Bi is such that the disappearance or occurrence of a phase in two component

alloys can be demonstrated easily by means of superconductivity measurements. Author

N75-33223*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADDITION OF OXYGEN TO AND DISTRIBUTION OF OXIDES IN TANTALUM ALLOY T-111 AT LOW CONCENTRATIONS
Stephan Stecura Washington Oct. 1975 24 p refs
(NASA-TM-X-3300; E-8358) Avail: NTIS HC $3.25 CSCL 11F

Oxygen was added at 820 and 990 C at an oxygen pressure of about .0003 torr. The technique permitted predetermined and reproducible oxygen doping of the tantalum alloy (T-111). Based on the temperature dependency of the doping reaction, it was concluded that the initial rates of oxygen pickup are probably controlled by solution of oxygen into the T-111 lattice. Although hafnium oxides are more stable than those of tantalum or tungsten, analyses of extracted residues indicate that the tantalum and tungsten oxides predominate in the as-doped specimens, presumably because of the higher concentrations of tantalum and tungsten in the alloy. However, high-temperature annealing promotes gettering of dissolved oxygen and oxygen from other oxides to form hafnium oxides. Small amounts of tantalum and tungsten oxides were still present after high temperature annealing. Tungsten oxide (WO3) volatilizes slightly from the surface of T-111 at 990 C but not at 820 C. The vaporization of WO3 has no apparent effect on the doping reaction. Author

N75-33224# Defence Research Establishment Valcartier (Quebec).
A CRITICAL REVIEW OF URANIUM RESEARCH AT DREV, 1963 - 1973
J. P. Drolet Jul. 1975 54 p refs
(DREV-4024/75) Avail: NTIS HC $4.25

A decade of internal and sponsored uranium research with more than 25 reports on in-house and research investigations made under contracts and university grants is presented. Alloy developments are presented of more than 100 binary, ternary and quaternary uranium alloys and extensive investigations of the two most promising alloys, the quaternary U-IMo-IZr-INb and the binary U-2Mo are examined. Various other aspects of uranium metallurgy, such as powder metallurgy, grain growth, pyrophoricity and directional casting, are briefly described. For individual titles, see N75-33225 through N75-33228.

N75-33225 Defence Research Establishment Valcartier (Quebec).
ALLOY DEVELOPMENT
In its A Critical Rev. of Uranium Res. at DREV, 1963 - 1973 Jul. 1975 p 2-9 refs (For availability see N75-33224 24-26)

The mechanical properties for uranium are discussed when it is alloyed with the metals of Mo, Ti, Nb, V, Cr, Mn, Si, Co, Fe, W, Ta, and S. The influence of tempering, quenching, and aging is also discussed. Tensile and notch-impact tests were performed to determine hardness of the alloys. J.R.T.

N75-33226 Defence Research Establishment Valcartier (Quebec).
THE U-1Mo-1Zr-1Nb ALLOY
In its A Critical Rev. of Uranium Res. at DREV, 1963 - 1973 Jul. 1975 p 9-16 (For availability see N75-33224 24-26)

Various processes were used to improve the mechanical properties of an U-I Mo-IZr-INb alloy, namely hot working (extrusion), vacuum degassing, and thermomechanical treatments. Bend strength, tensile stresses, and compression tests were performed on the alloy for the above mentioned processes. Results indicate that the hot working process produces better overall mechanical properties. Grain boundaries, microstructural changes, and deformation at high temperature were also examined. J.R.T.

N75-33227 Defence Research Establishment Valcartier (Quebec).
THE U-Mo SYSTEM
In its A Critical Rev. of Uranium Res. at DREV, 1963 - 1973 Jul. 1975 p 17-30 (For availability see N75-33224 24-26)

The microstructure and mechanical properties of uranium-molybdenum alloys, U-2Mo, which were heat treated is discussed. Grain boundaries were examined, and in general, results indicate that the toughest structure occurs when the grain boundary is fairly fine and uniform, without coarse grain structure or precipitates. Phase transformations are examined. Aging was studied; and a fractographic analysis was performed. Phase diagrams are shown. Also considered was a comparison of the mechanical properties of a quaternary alloy, U-IMo-IZr-INb, and the U-2Mo binary alloys. The quaternary alloy is shown to be superior in mechanical properties, primarily attributed to its ductility. The thermomechanical processing of U-3Mo, U-4Mo, and U-5Mo alloys was also examined. J.R.T.

N75-33228 Defence Research Establishment Valcartier (Quebec).
MISCELLANEOUS STUDIES
In its A Critical Rev. of Uranium Res. at DREV, 1963 - 1973 Jul. 1975 p 30-50 refs (For availability see N75-33224 24-26)

Various areas of uranium metallurgy were investigated: (1) grain size and grain growth of the unalloyed metal; the best combinations of mechanical properties were obtained in fully recrystallized uranium metal; (2) the sintering of fine uranium powder produced from the hydride, UH3; sintering is shown to occur at a very low temperature (600 C); (3) the ignition temperature (700 C) of various uranium alloys, heated under varying pressures of O2, N2 and water vapor; and (4) castings of various uranium alloys which were examined for their mechanical properties. J.R.T.

N75-33229*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
INFLUENCE OF GASEOUS HYDROGEN ON THE MECHANICAL PROPERTIES OF INCOLOY 903 Final Report
Sep. 1975 51 p refs
(Contract NAS8-30744)
(NASA-CR-143982; PWA-FR-7175) Avail: NTIS HC $4.25 CSCL 11F

Solid specimens of the alloy Inconel 903 (iron based alloy) were exposed to four gaseous environments and high temperatures. Air, pure helium, pure hydrogen, and hydrogen and water vapor combined were the gaseous environments employed, and the temperature was 1400 F. Various mechanical property tests (low cycle fatigue, creep-rupture, tensile properties) were performed on the alloy. Results indicate that the hydrogen and water vapor environment cause a sharp reduction in the mechanical properties of the alloy. Photographs of the test equipment used and the microstructure of the tested alloy are included. J.R.T.

N75-33230*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
PREDICTION AND VERIFICATION OF CREEP BEHAVIOR IN METALLIC MATERIALS AND COMPONENTS FOR THE SPACE SHUTTLE THERMAL PROTECTION SYSTEM. VOLUME 3, PHASE 3: FULL SIZE HEAT SHIELD DATA CORRELATION AND DESIGN CRITERIA
B. A. Cramer and J. W. Davis Washington NASA Aug. 1975 206 p refs
(Contract NAS1-11774)
(NASA-CR-132605-3) Avail: NTIS HC $7.25 CSCL 11F

Analysis methods for predicting cyclic creep deflection in stiffened metal panel structures, were applied to full size panels. Results were compared with measured deflections from cyclic tests of thin gage L605, Rene' 41, and TDNiCr full size corrugation stiffened panels. A design criteria was then formulated for metallic thermal protection panels subjected to creep. A computer program was developed to calculate creep deflections. Author

N75-33231*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF THERMAL CYCLING IN A MACH 0.3 BURNER RIG ON PROPERTIES AND STRUCTURE OF DIRECTIONALLY SOLIDIFIED GAMMA/GAMMA PRIME - DELTA EUTECTIC
Hugh R. Gray and William A. Sanders Washington Oct. 1975 32 p refs
(NASA-TM-X-3271; E-8272) Avail: NTIS HC $3.75 CSCL 11F

Tensile and stress rupture properties at 1040 C of a thermally cycled gamma/gamma prime - delta eutectic were essentially equivalent to the as-grown properties. Tensile strength and rupture life at 760 C appeared to decrease slightly by thermal cycling. Thermal cycling resulted in gamma prime coarsening and Widmanstatten delta precipitation in the gamma phase. An unidentified precipitate, presumably gamma prime, was observed within the delta phase. The eutectic alloy exhibited a high rate of oxidation-erosion weight loss during thermal cycling in the Mach 0.3 burner rig. Author

N75-33232# Atomic Energy Commission, San Francisco, Calif.
PRESSURE DERIVATIVES OF ELASTIC MODULI IN BCC TRANSITION METALS AND THEIR SOLID SOLUTIONS Progress Report, 1 Jun. 1974 - 20 Apr. 1975
1975 11 p refs
(UH-235P12X1) Avail: NTIS HC $4.00

Activities in research programs are reported on pressure derivatives of elastic moduli in Nb-Mo alloys and in Ta. Data on second order adiabatic elastic moduli and their pressure derivatives in these alloys and in Ta are tabulated. Data are also presented and discussed on the electron-to-atom ratio relations with density and moduli for Nb-Mo alloys. NSA

N75-33233# California Univ., Livermore. Lawrence Livermore Lab.
FRACTURE-TOUGHNESS TESTS ON A HIGH-STRENGTH BERYLLIUM FROM ROOM TEMPERATURE TO 300 DEG C
M. Perra and I. Finnie 10 Mar. 1975 29 p refs
(Contract W-7405-eng-48)
(UCRL-51774) Avail: NTIS HC $4.00

Fatigue cracks were generated in 8.92-mm-thick double cantilever beam specimens by a reversed-loading method. Room temperature fracture toughness data from tests on specimens with Elox-machined notches and fatigue precracks were compared. Electron fractographs of fatigue and fast fracture regions were obtained. Load displacement records generated from tests on specimens with natural cracks were nonlinear, whereas tests on specimens with machined cracks gave the expected linear records. Evidence points to crack closure phenomenon rather than plasticity as the source of the nonlinearity. Author (NSA)

N75-33234# Oak Ridge National Lab., Tenn.
ELEVATED TEMPERATURE FATIGUE BEHAVIOR OF 21/4 Cr-1 Mo STEEL
C. R. Brinkman, J. P. Strizak, and W. R. Corwin 1975 26 p refs Presented at the 2d ASME Nat. Congr. on Pressure Vessels and Piping, San Francisco, 23-27 Jun. 1975 Sponsored by ERDA
(CONF-750617-1) Avail: NTIS HC $4.50

Results are reported for a number of load and strain controlled fatigue tests conducted over the temperature range of room temperature to 1000 F. Cyclic hardening and softening characteristics for a single heat of 2 1/4 Cr-1 Mo steel in the isothermally annealed condition are discussed. Comparisons of the data generated in this effort are made with data available from the literature. Design fatigue curves were prepared covering continuous high and low cycle behavior over the temperature range of room temperature to 1100 F. Equations for these design curves are also given. Author (NSA)

N75-33235# Laboratoire Suisse de Recherches Horlogeres, Neuchatel (Switzerland).
WEAR OF SLIP RINGS AND BRUSHES IN ULTRA-HIGH VACUUM
M. Maillat, F. Aubert, H. E. Hintermann, and R. Rocchi Risley, Engl. Natl. Centre of Tribology Oct. 1974 45 p In FRENCH
(Contract ESTL-4-R-52224.13)
(ESRO-ESTL-14; ESRO-CR(P)-653; Rept-980-1.1) Avail: NTIS HC $3.75

The ultrahigh vacuum friction and wear behavior of a material for sliding electric contacts composed of 82.5 Ag, 15 Mo S2, and 2.5 Cu is examined. Tests were made according to the three orientations of the material's structure with a view to determining the influence with respect to friction direction. The results are highly dispersed. The friction parallel to the structural lines and perpendicular to the milling direction provides a reproducible and weaker wear. These phenomena seem to originate from fabrication defects of the materials. ESA

N75-33236# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
INTERFACE DOSE AS A FUNCTION OF ANGLE OF INCIDENCE FOR ALUMINUM-GOLD AND ALUMINUM-BERYLLIUM SLABS Physical Sciences Research Papers
L. F. Lowe, W. C. Taylor, and J. R. Cappelli 11 Apr. 1975 9 p refs
(AF Proj. 5621)
(AD-A011601; AFCRL-PSRP-629) Avail: NTIS CSCL 18/4

The effect of Co-60 gamma ray incidence angle on dose enhancement at interfaces of dissimilar materials has been measured. Materials studied were gold, aluminum, and beryllium. Maximum enhancement was found at normal incidence with the low atomic numbered material facing the radiation source and the minimum at 180 degrees. The experimental results were compared to Monte Carlo calculations at lower energies. GRA

N75-33237# Sussex Univ., Brighton (England). Dept. of Chemistry.
COMPUTER ANALYSIS OF THERMO CHEMICAL DATA (CATCH TABLES): Cr, Mo AND W COMPOUNDS
J. B. Pedley, A. Kirk, E. Winser, L. G. Heath, and D. S. Barnes Jun. 1974 34 p refs
(Grant AF-AFOSR-2220-72; AF Proj. 9536)
(AD-A010503; AFOSR-75-0719TR) Avail: NTIS CSCL 07/4

The report lists heats of reaction and formation for chromium, molybdenum, and tungsten oxides and halides, and for some chromates, molybdates, and tungstates. GRA

N75-33238# British Iron and Steel Research Association, London (England). Strip Mills Div.
A LABORATORY INVESTIGATION OF THE PROCESSING BEHAVIOUR AND PROPERTIES OF NIOBIUM BEARING E.D.D. STEELS
R. J. Hazel and R. C. Hudd Apr. 1975 28 p refs
(PB-242500/7; BISRA-SM/734/A) Avail: NTIS HC $3.75 CSCL 11F

A laboratory investigation of the processing behavior and properties that may be obtained in cold rolled and annealed, very low carbon steel containing niobium was carried out. The work confirmed that EDD steels with drawing properties superior to those of existing aluminium stabilized steel may be obtained. A wide variation in properties was, however, produced due to the extreme difficulties in controlling laboratory hot rolling. Best properties were produced when a fine precipitate distribution was present in the hot band and when there was a pronounced hot band texture. As with titanium bearing steels, the niobium bearing steels recrystallize during annealing at higher temperatures than aluminum stabilized steel. GRA

N75-33239# National Bureau of Standards, Washington, D.C. Center for Consumer Product Technology.
SPECIAL REPORT ON ALUMINUM WIRE
3 Sep. 1974 93 p refs
(PB-242208/7) Avail: NTIS HC $4.75 CSCL 09A

The nature of the connection between aluminum wiring and various terminations, the best technical understanding of the mechanism of the connection, and the mechanism of failures were studied. Four major problems found with aluminum wire were the high coefficient of thermal expansion, the high amount of stress relaxation as compared to steel and copper alloys, the tendency to oxidize readily, and the high electrical resistance which requires thick sections. It was suggested that many types of connectors could be designed for aluminum and copper wires which would be easy to use, would cost only slightly more, and would be safer. GRA

N75-33240# British Iron and Steel Research Association, London (England).
METALLOGRAPHY OF FOAMING SLAGS
E. Johnson Apr. 1975 14 p refs
(PB-242498/4; BISRA-GS/PROD/9/18/74/C) Avail: NTIS HC $3.25 CSCL 11F

Samples of foaming and nonfoaming slags were examined

by optical and scanning electron microscopy to investigate the phenomena of foaming. Small carbon rich metallic globules were found entrapped in the foaming slag samples but nothing was seen on the pore surface to account for the foam stability. The optical and chemical assessments of the slag have, however, confirmed several observations made in work published by other investigators. GRA

N75-33241# British Iron and Steel Research Association, London (England).
A TENTATIVE METHOD FOR THE DETERMINATION OF ZIRCONIUM IN STEEL
H. J. Boniface, C. Aitchison, and R. OLeary Mar. 1975 6 p refs
(PB-242504/9; BISRA-SM/TN/A/380) Avail: NTIS HC $3.25 CSCL 11F

A method is presented for the determination of zirconium in plain carbon steels in the range 0.0005% to 0.20% Zr. It is based on the work of Staats et al and Shizuya Mackawa et al and employs cupferron separation and photometric determination of the Zr-catechol violet complex. Results obtained when the method was applied to a standard steel indicate good precision. GRA

N75-33242# British Iron and Steel Research Association, London (England).
INDUCED ELECTROMAGNETIC STIRRING IN ELECTRO-SLAG REMELTING
D. I. Dawson and A. Siswick Apr. 1975 18 p refs
(PB-242497/6; BISRA-CDL/ESD/6/74) Avail: NTIS HC $3.25 CSCL 11F

The feasibility of inducing circulatory stirring in the slag bath during the electroslag remelting of ingots of up to 310 mm diameter was investigated. Observations were made of the motor effects produced by external stirring coils in respect of ingot structure, surface finish, melt-stability, efficiency, and rate. GRA

N75-33243# British Steel Corp., London (England). General Steels Div.
TOWARDS IMPROVED SUBMERGED-ARC WELD METAL TOUGHNESS
J. G. Garland and P. R. Kirkwood Apr. 1975 33 p refs
(PB-242574/2; BISRA-GS/PROD/MISC/91/74/C) Avail: NTIS HC $3.75 CSCL 13H

A fundamental study into factors controlling weld metal toughness in structural steel revealed previously unrecognized correlations between weld metal microstructures and properties, in particular the role of pools of martensitic microphase. A weld metal toughness model was evolved, which proved capable of explaining recorded property levels in submerged-arc welds in structural steels, with and without microalloying additions, over a range of welding consumables (including Mo-bearing wires) and procedures. Recommendations were made regarding consumable and procedure selection for critical submerged-arc welding applications and a route for improved wire composition was identified. Initial work on wire development produced a family of low carbon-molybdenum-boron-titanium wires with very much superior performance. GRA

N75-33244# British Steel Corp., London (England). Corporate Development Laboratory.
FAILURE IN SHEET FORMING
I. L. Dillamore and R. A. Maynard 1 Apr. 1975 37 p refs
(PB-242496/8; BISRA-CDL/MT/9/74) Avail: NTIS HC $3.75 CSCL 13H

The role of inclusions in sheet steel for forming applications is discussed along with formability limited by plastic instability and steel cleanliness, and its relation to stretch forming behavior. It is concluded that while inclusions almost certainly cause failure, the benefits conferred by improved cleanness are strictly limited. Some operations are manifestly influenced by inclusion content and form and these are briefly discussed. GRA

N75-33245# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.
THE STRUCTURE AND MECHANICAL PROPERTIES OF INTERNALLY OXIDIZED Cu-Ti POLYCRYSTALS
James Greggi, William A. Soffa, and Gerald H. Meier 19 May 1975 56 p refs
(Contract N00014-75-C-0747)
(AD-A010885; ME-IO-75-3) Avail: NTIS CSCL 11/6

The structure and mechanical properties of internally oxidized Cu-Ti polycrystals was studied for a range of Ti concentrations and oxidation temperatures. The average TiO2 particle size varied from 76 A for Cu-0.25 wt% Ti oxidized at 750 C to 370 A for Cu-1.0 wt% Ti oxidized at 1000 C. For oxidation temperatures above 850 C the TiO2 particles had the rutile crystal structure and below 800 C the anatase structure. Between 800 and 850 C the two structures were found to coexist. Orientation relationships with the Cu matrix were found and evaluated for both rutile and anatase particles. The TiO2 dispersion was found to markedly increase the yield strength of Cu and the yield strength data were found to agree well with the predictions of a modified Orowan theory. The alloys exhibited considerable elongation despite the fact that fracture was associated with oxide particles on the grain boundaries. GRA

N75-33246# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.
STRUCTURE AND PROPERTIES OF CAST ALLOYS: 1. THE GROWTH AND THERMAL STABILITY OF UNI-DIRECTIONALLY SOLIDIFIED Nb-Nb2C COMPOSITES. 2: STRUCTURE AND PROPERTIES OF CAST NONFERROUS ALLOYS Interim Report
Stan A. David and Harold D. Brody Feb. 1975 52 p refs
(Contract N00014-75-C-0800; NR Proj. 031-729)
(AD-A010886; SETEC-MM-75-022) Avail: NTIS CSCL 11/6

By a floating zone melting and freezing technique, eutectic and hyper-eutectic Nb-Nb2C alloys may be grown with well aligned two phase composite structures. The morphology of the carbide phase may be rod-like, plate-like or a combination of rods and plates depending on the growth rate and carbon content. The rod spacing or plate-spacing is a function of growth rate. The structural stability of as grown rod-like Nb-Nb2C composites grown at two different growth rates and the stability of deformed Nb-Nb2C composites have been examined after isothermal annealing at temperatures in excess of one half the eutectic temperature for periods up to 700 hrs. In part two, aspects of cast structure, including interfaces, segregation, particles, and discontinuities, are discussed in relation to their dependence on casting conditions and in relation to their effect on properties. GRA

N75-33247# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
MAGNETIC INTERACTIONS IN NiSnCl6-6H2O AND RELATED SALTS
S. A. Friedberg, M. Karnezos, and D. Meier 1 Jun. 1975 7 p refs
(Contract N00014-75-C-0771; NR Proj. 318-026)
(AD-A010880; TR-1) Avail: NTIS CSCL 07/4

Heat capacities and low field magnetic susceptibilities of single crystal NiSnCl6-6H2O and six other isostructural Ni compounds were measured down to approximately 0.05 K. In NiSnCl6-6H2O, NiPdCl6-6H2O, NiPtCl6-6H2O, NiPtBr6-6H2O, and NiPtI6-6H2O the S = 1 ground state of the [Ni(H2O)6] complex is split into a lower singlet and an upper doublet. Spin coupling in these compounds is subcritical and of antiferromagnetic sign. In NiTiF6-6H2O and NiZrF6-6H2O the zero field splitting leaves the doublet lowest, interactions are ferromagnetic, and ferromagnetic ordering occurs below T sub c approximately 0.17 K. Author

N75-33248# Naval Ship Research and Development Center, Bethesda, Md. Materials Dept.
ENHANCEMENT OF FATIGUE, CREEP, AND STRESS-CORROSION RESISTANCE BY SURFACE TREATMENTS
I. R. Kramer Jun. 1975 30 p refs Submitted for publication
(AD-A011038; NSRDC-4546) Avail: NTIS CSCL 13/8

By considering the nature of the surface layer formed as a result of plastic deformation, substantial improvements may be made in the fatigue, creep, and stress-corrosion cracking resistance. When the surface layer stress is decreased, the fatigue and stress-corrosion cracking resistance is increased. When its relaxation rate is decreased, the creep rate is also decreased. GRA

N75-33249# United States Steel Corp., Monroeville, Pa. Research Lab.

THE EFFECT OF HYDROSTATIC PRESSURE ON THE DEFORMATION BEHAVIOR OF MARAGING AND HY-80 STEELS AND ITS IMPLICATIONS FOR PLASTICITY THEORY Final Report, 1 Mar. 1974 - 1 Mar. 1975

William A. Spitzig, Robert J. Sober, and Owen Richmond Apr. 1975 44 p refs

(Contract N00014-73-C-0092)

(AD-A010543; Rept-76-H-006(064)-75) Avail: NTIS CSCL 11/6

Earlier results showed that the difference between the tensile and compressive strengths of tempered martensites is primarily a manifestation of the general pressure dependence of flow stress in these materials. However, the same results also showed that the volume expansion after deformation was much smaller than that predicted by the normality flow rule of plasticity theory for materials with such pressure dependence. Additional results now obtained on maraging and HY-80 steels support these conclusions. The results for all these materials exhibit a strong, but not perfect, correlation between pressure dependence, yield stress, and volume expansion. The results suggest that an appropriate plasticity model would be one in which the octahedral shear is linearly dependent on the mean pressure, but the volume change is negligible in violation of the normality flow rule. Such a model has been proposed previously for the plastic deformation of soils. GRA

N75-33250# Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.

ION MICROPROBE ANALYSIS FOR NIOBIUM HYDRIDE IN HYDROGEN EMBRITTLED NIOBIUM

Howard K. Birnbaum, Martin L. Grossbeck, Peter Williams, and Charles A. Evans, Jr. Apr. 1975 12 p refs

(Contract N00014-67-A-0305-0020)

(AD-A010548) Avail: NTIS CSCL 11/6

Hydrogen embrittled niobium samples have been examined in an ion microprobe to verify the mechanism of embrittlement by stress induced precipitation of hydride. A fractured Nb-2 at.% H sample was examined in detail. Mass analyzed images of the fracture region of the sample were obtained using Nb(+), NbH(+), H(+), and NbO(+) ions. The images clearly demonstrate the presence of a hydrogen-rich phase at the fracture site. NbH(+)/Nb(+) ratios at the fracture site and away from it appear characteristic of niobium hydride and Nb-H solid solution respectively. Scanning electron microscope and electron diffraction studies together with the ion microprobe analysis provide strong evidence in support of the theory of hydrogen embrittlement by stress-induced precipitation of niobium hydride. GRA

N75-33251# Environmental Health Lab., Kelly AFB, Tex.

INSTRUMENT CORROSION DURING STERILIZATION AT USAF HOSPITAL, DYESS AFB, TEXAS

Edward E. LeFebvre and Samuel A. Britt May 1975 25 p refs

(AD-A010587; EHL(K)-75-5) Avail: NTIS CSCL 06/12

Pitting and corrosion of surgical instruments during autoclave sterilization has been a problem for the past few years at USAF Hospital, Dyess AFB TX. The USAF Environmental Health Laboratory Kelly responded to an urgent request for analytical service in January 1975 to determine possible causes in the steam and boiler system. Field analysis indicates the problem was most likely to be free carbon dioxide in the steam lines from thermal decomposition of carbonates and bicarbonates found in the boiler feed water. The water softener and dealkalizer were put into operation and a new automatic chemical feed system ordered. A second visit to perform on-site analysis was requested and accomplished in April 1975. The autoclave was found, at that time, to be connected to a 40 psi steam line rather than the recommended 50-80 psi line. Occasional inadequate rinsing of linens during laundering has also contributed to instrument spotting. GRA

N75-33252# Watervliet Arsenal, N.Y.

FEASIBILITY OF BORIDING ALLOY STEELS AT TEMPERATURES BELOW 1000 F

Vito J. Colangelo and Bruce A. Fosnocht Mar. 1975 36 p refs

(AD-A010663; WVT-TR-75012) Avail: NTIS CSCL 11/3

The report concerns the results of a feasibility study that was conducted to determine whether or not alloy steels could be borided to achieve an iron boride layer of .001 to .005 inch at temperatures of 1000 F or lower. The purpose of boriding in this temperature range is to create a wear resistant surface without over-tempering the substrate steel. Results of the study have shown that the alloy steel cannot be borided effectively at temperatures of 1000 F or lower. The study has shown that minimum practical temperatures for .0005 inch boride diffusion are approximately 1100 F for low-carbon steel and 1250 F for alloy steel. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N75-33253*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE EFFECTS OF ENVIRONMENTAL EXPOSURE ON REUSABLE SURFACE INSULATION FOR SPACE SHUTTLE

Philip O. Ransone and J. D. Morrison Washington Oct. 1975 27 p refs

(NASA-TM-X-3252; L-10022) Avail: NTIS HC $3.75 CSCL 11C

Coated specimens of reusable surface insulation (RSI) were exposed to alternate radiant heating and atmospheric exposure cycles to study the effects of surface contamination on the RSI coating. Different methods of heating were employed on clean and artificially contaminated specimens to determine the contributions of heating conditions to coating devitrification. Author

N75-33254# Ballistic Research Labs., Aberdeen Proving Ground, Md.

THE DETERMINATION OF THE EFFECTIVE ABSORPTANCE OF SELECTED PAINTS

James P. Weygandt and David T. Kilminster Mar. 1975 40 p refs

(DA Proj. 1W1-62118-AD-51)

(AD-A007730; BRL-MR-2444) Avail: NTIS CSCL 11/3

Studies were conducted to determine the optical absorption characteristics of various paints and coatings used on Army systems. The method used to determine the temperature-dependent effective absorptance consisted of heating a painted sample with a thermal light source and analyzing the rate of the increase in temperature. This report presents the derivation of equations required to determine the effective absorptance and the experimental procedures involved in obtaining the time-dependent temperatures of the samples. GRA

N75-33255# Pennwalt Corp., King of Prussia, Pa. Research and Development Dept.

INORGANIC COORDINATION POLYMERS. 18. OBSERVATIONS ON BRITTLE AND FLEXIBLE FILMS OF Cr OP CH3 C6H5 O2 OP C8 H17 Ox

Piero Nannelli, H. D. Gillman, and B. P. Block May 1975 21 p refs

(Contract N00014-69-C-0122; NR Proj. 356-408)

(AD-A010554; TR-14) Avail: NTIS CSCL 07/2

Films of Cr(OP(CH3)(C6H5)O)2(OP(C8H17)2O))x, formed during the reaction of (Cr(OH)(OP(CH3)(C6H5)O)2)x with dioctylphosphinic acid, are either brittle or flexible depending on the details of the preparation of the chromium(III) bis(phosphinate) precursor. Both kinds of film appear to contain mainly triple-bridged chains. Differing degrees of randomness in distribution of the two kinds of phosphinate bridges and, hence, of the internally plasticizing octyl groups along the chain account for the observed differences in flexibility, X-ray diffraction patterns, and birefringence. The observed intrinsic viscosities of 9-18 dl/g indicate that these tris(phosphinates) form microgels rather than true solutions. The thermal degradation of these films proceeds

by the oxidation and cleavage of the organic side groups. Addition of antioxidants to the flexible films significantly increases the longevity of their flexibility at 200C. GRA

N75-33256# National Bureau of Standards, Washington, D.C. Inorganic Materials Div.
STRENGTH DEGRADATION OF BRITTLE SURFACES: SHARP INDENTERS Interim Report, 1 Jul. 1974 - 30 Jun. 1975
B. R. Lawn, E. R. Fuller, and S. M. Wiederhorn May 1975 39 p refs Sponsored in part by Office of Naval Res., Arlington, Va.
(COM-75-10763/1; NBSIR-75-661) Avail: NTIS HC $3.75 CSCL 11B

A theory of strength loss for brittle surfaces in contact situations developed for 'blunt' indenters, is extended to the case of 'sharp' indenters. A prior fracture mechanics analysis of crack growth beneath ideal cone indenters serves as the basis for predetermining the prospective surface degradation of ceramic components in service. The effect of indenter sharpness and initial specimen surface flaw state are investigated systematically, along with some secondary rate effects in the contact process. The possibility of minimizing degradation via adjustment of material parameters (including hardness) or surface condition (e.g., residual stresses, frictional properties) is briefly discussed. GRA

N75-33257# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Materials Engineering.
GRIFFITH FRACTURE EQUATION: AN EXPERIMENTAL TEST
Robert H. Doremus and Edward K. Pavelchek Jun. 1975 13 p refs
(Contract N00014-67-A-0117-0014; NR Proj. 023-531)
(AD-A011111) Avail: NTIS CSCL 11/2

The Griffith Fracture Equation was not followed when the strengths of rods of soda-lime glass tested immediately after abrading and after abrading and then aging 24 hours in water were compared. The aged samples were stronger than samples not aged, but the cracks in both were of nearly the same length. Two possible explanations of this discrepancy are explored. GRA

N75-33258# Aerospace Corp., El Segundo, Calif. Lab Operations.
PRELIMINARY EVALUATION OF A NEW HIGH-TEMPERATURE POLYMER Interim Report
William L. James 7 May 1975 33 p refs
(Contract F04701-74-C-0075)
(AD-A010598; TR-0075(9250-07)-1; SAMSO-TR-75-126) Avail: NTIS CSCL 11/9

Some developments in processing a new high-temperature resin system are described. This new class of tractable polyphenylene polymers recently became available from Hercules, Inc., and has been evaluated from the standpoint of handling, processing, and performance characteristics. A dramatic improvement was achieved in ease of fabrication as compared with conventional polymers. This was accomplished with no observable sacrifice in high-temperature performance. Despite inherent limitations in the adhesive properties of this polymer system, fiber and fabric-reinforced composites with acceptable mechanical properties were successfully fabricated. A preliminary effort to graphitize a carbon-reinforced specimen with the polyphenylene matrix indicated that the system has promise for production of mechanically sound carbon-carbon composites. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N75-33259*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ASRDI OXYGEN TECHNOLOGICAL SURVEY. VOLUME 9: OXYGEN SYSTEMS ENGINEERING REVIEW
Harold W. Schmidt and Donald E. Forney Washington 1975 218 p refs
(NASA-SP-3090) Avail: NTIS HC $7.50 CSCL 07D

The design and safe operation of O2 systems at high pressures and temperatures are discussed. Data cover O2 reactivity with system materials, environmental limits, flow rate, contamination, and physical and chemical stresses of materials. For individual titles, see N75-33260 through N75-33268.

N75-33260* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERISTICS OF OXYGEN
In its ASRDI Oxygen Technol. Survey, Vol. 9 1975 p 3-11 (For availability see N75-33259 24-28)
CSCL 07D

Oxygen reactivity and the design of special hardware to be used in oxygen service are discussed. Safety factors, passing mixing characteristics, and oxygen absorption by porous materials are considered. Special attention was given to system failure prevention and resulting hazards, costs, and time loss. E.H.W.

N75-33261* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MATERIALS SELECTION CRITERIA AND DATA
In its ASRDI Oxygen Technol. Survey, Vol. 9 1975 p 13-56 (For availability see N75-33259 24-28)
CSCL 07D

The properties of materials selected for use in oxygen systems are examined. Specifically, materials are selected according to trade-offs between chemical compatibility, ignition temperature, combustion characteristics, and physical properties. Quantitative energy sources and energy release rates capable of causing material combustion or explosion were also considered. E.H.W.

N75-33262* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OXYGEN SYSTEMS ENGINEERING CONSIDERATIONS
In its ASRDI Oxygen Technol. Survey, Vol. 9 1975 p 57-73 (For availability see N75-33259 24-28)
CSCL 13K

Special considerations for oxygen systems engineering with respect to system design, fabrication, and use are studied. The concerns for oxygen systems include the problems of leakage and erosion, difficulties that arise from dynamic processes, and the sensitivity of oxygen systems to contamination and cleaning requirements. Author

N75-33263* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OXYGEN TANK ASSEMBLIES
In its ASRDI Oxygen Technol. Survey, Vol. 9 1975 p 74-91 refs (For availability see N75-33259 24-28)
CSCL 13D

Structural design considerations for O2 tank shells and suspension systems of ground based storage and mobile tank systems are outlined. Safety factors, chemical compatibility, liquid slosh strength, and cryogenic temperature properties are summarized. Finally, costs, quality control measures, and long life characteristics are examined. E.H.W.

N75-33264* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OXYGEN PUMPS
In its ASRDI Oxygen Technol. Survey, Vol. 9 1975 p 93-116 (For availability see N75-33259 24-28)
CSCL 13K

Special considerations to be given to the design, fabrication, and use of centrifugal pumps for liquid O2 to avoid conditions that lead to system failure are given. Emphasis was placed on turbine pumps for flight applications. Author

N75-33265* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VALVE ASSEMBLIES
In its ASRDI Oxygen Technol. Survey, Vol. 9 1975 p 117-127

(For availability see N75-33259 24-28)
CSCL 13K

Seals and sealing, especially relative to valve designs for O2 systems are investigated. Also considered are high pressure requirements, pressure and flow regulators, and check and relief valves. Valve failure as induced by overstress or abrasion, galling, and ignition of valve parts was detailed. E.H.W.

N75-33266* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LINES, CONNECTORS, JOINTS, AND FITTINGS
In its ASRDI Oxygen Technol. Survey, Vol. 9 1975 p 129-143
(For availability see N75-33259 24-28)
CSCL 13K

The structural reliability of lines, connectors, joints, and fittings used in liquid and gaseous O2 systems was examined. Overstress and high velocity flow of gaseous O2 as they affect system failure are also examined. Special attention was given to efforts to determine factors for designing a reliable O2 transport system for operation at all possible pressures. E.H.W.

N75-33267* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SEALS
In its ASRDI Oxygen Technol. Survey, Vol. 9 1975 p 145-161
(For availability see N75-33259 24-28)
CSCL 11A

Seal configurations generally found in fluid systems are given. Special attention is given to material selection and the process for achieving a seal. Seal material characteristics including wear resistance, creep, and cold flow properties are discussed. E.H.W.

N75-33268* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FILTERS
In its ASRDI Oxygen Technol. Survey, Vol. 9 1975 p 163-211 refs (For availability see N75-33259 24-28)
CSCL 13K

The role played by filters in providing failure free high pressure gaseous O2 system operation is defined. Filter design and maintenance considerations are given. E.H.W.

N75-33269*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMBUSTOR EXHAUST-EMISSIONS AND BLOWOUT-LIMITS WITH DIESEL NUMBER 2 AND JET A FUELS UTILIZING AIR-ATOMIZING AND PRESSURE ATOMIZING NOZZLES
Robert D. Ingebo and Carl T. Norgren 1975 15 p refs Presented at Western States Section of the Combustion Institute, Palo Alto, Calif., 20-21 Oct. 1975
(NASA-TM-X-71803; E-8483) Avail: NTIS HC $3.25 CSCL 21D

Experimental tests with diesel number 2 and Jet A fuels were conducted in a combustor segment to obtain comparative data on exhaust emissions and blowout limits. An air-atomizing nozzle was used to inject the fuels. Tests were also made with diesel number 2 fuel using a pressure-atomizing nozzle to determine the effectiveness of the air-atomizing nozzle in reducing exhaust emissions. Test conditions included fuel-air ratios of 0.008 to 0.018, inlet-air total pressures and temperatures of 41 to 203 newtons per square centimeter and 477 to 811 K, respectively, and a reference velocity of 21.3 meters per second. Smoke number and unburned hydrocarbons were twice as high with diesel number 2 as with Jet A fuel. This was attributed to diesel number 2 having a higher concentration of aromatics and lower volatility than Jet A fuel. Oxides of nitrogen, carbon monoxide, and blowout limits were approximately the same for the two fuels. The air-atomizing nozzle, as compared with the pressure-atomizing nozzle, reduced oxides-of-nitrogen by 20 percent, smoke number by 30 percent, carbon monoxide by 70 percent, and unburned hydrocarbons by 50 percent when used with diesel number 2 fuel. Author

N75-33270# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
NONEQUILIBRIUM PROPELLANT AND FUEL COMBUSTION REACTIONS [NICHTGLEICHGEWICHTSREAKTIONEN BEI DER VERBRENNUNG VON TREIB- UND BRENNSTOFFEN]
F. Volk 31 Dec. 1974 18 p refs In GERMAN
(ICT-6/74) Avail: NTIS HC $3.25

The difference between equilibrium and nonequilibrium combustion reactions is exemplified. Nitric oxide formation in hydrocarbon-air flames in piston engines is examined in terms of the reaction kinetics of elementary combustion reactions. Experimental investigations on the composition of the combustion gases of double base solid propellants as a function of the density indicates that a combustion reaction can be characterized by the combustion smoke. Even when the reaction kinetics are not exactly known one can thus decide whether a performance calculation based on thermodynamics is feasible. ESA

N75-33271# Institut Franco-Allemand de Recherches, St. Louis (France).
PROJECTION OF PREFORMED PROJECTILES AND TUBULAR COATINGS WITH PREDETERMINED FRAGMENTATION [QUELQUES EXPERIENCES DE PROJECTION D'ECLATS PREFORMES ET DE REVETEMENTS TUBULAIRES A FRAGMENTATION PREDETERMINEE]
Y. DeLongueville 19 Jul. 1974 42 p refs In FRENCH
(ISL-25/74) Avail: NTIS HC $3.75

Experiments were conducted to determine the best way to keep the integrity of spheres projected from a mono or bimetallic matrix upon deflagration of a block of hexolite explosive. Parameters for predetermined fragmentation of tubular containers were studied. It is shown that a bimetallic matrix of Dural/brass yields a 50% velocity increase for the spheres whereas an orthogonal network of grooves of given dimensions ensure adequate fragmentation. ESA

N75-33272# Explosives Research and Development Establishment, Waltham Abbey (England).
THE USE OF THE CONTINUOUS FLOW METHOD OF SURFACE AREA MEASUREMENT FOR AMMONIUM PERCHLORATE
C. M. S. Jones and B. G. Tucker Apr. 1974 20 p refs
(ERDE-TR-177; BR46203) Avail: NTIS HC $3.25

The suitability of the continuous flow gas adsorption method for the measurement of the surface area of ammonium perchlorate was investigated. It was found to be a suitable method over the entire range of particle size now used or likely to be used in solid propellants. Author (ESRO)

N75-33273# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
OPTIMUM AUTOMOTIVE USE OF THE COMBUSTION CHARACTERISTICS OF GAS FROM COAL LOW POLLUTION CONSIDERATIONS
J. R. Allsup and R. D. Fleming Apr. 1975 21 p refs
(PB-242184/0; BM-RI-8040) Avail: NTIS HC $3.25 CSCL 21D

The characteristics were studied of simulated coal gas as an automotive fuel in two multicylinder vehicles in a standard and high compression-ratio engine configuration. The investigation emphasized the engine parameters necessary for optimum use of the fuel with respect to engine efficiency and low exhaust emissions. GRA

N75-33274# Maryland Univ., College Park. Dept. of Mechanical Engineering.
A REVIEW OF FACTORS AFFECTING DAMAGE IN BLASTING
Anders Ladegaard-Pedersen and James W. Dally Jan. 1975 179 p refs
(Grant NSF GI-39320)
(PB-242224/4; NSF/RA/T-75-016) Avail: NTIS HC $7.00 CSCL 19D

An extensive review is presented of four different characteristics of blasting which can produce damage to inhabitants, vehicles, or structures in urban areas. These include the air blast wave, the noise associated with the venting of the charge, the stress waves propagating into adjacent regions producing ground vibration, and the debris ejected from the crater or bench face when the bore hole is overcharged. Fundamental relations are

reviewed in each case and, where possible, explicit theoretical results are presented in terms of scaled parameters which permit predictions to be made for any size charge. GRA

N75-33275# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
MONOPROPELLANT DROPLET DECOMPOSITION FOR LARGE ACTIVATION ENERGIES Interim Report
Amable Linan Dec. 1974 46 p refs
(Grant AF-AFOSR-2535-73; AF Proj. 9711)
(AD-A010930; SR-1; AFOSR-75-0817TR) Avail: NTIS CSCL 21/2

The quasi-steady decomposition of a monopropellant droplet in a quiescent atmosphere is analyzed for an Arrhenius reaction. An analytical relation is obtained for the pre-exponential rate constant, or the Damkohler number, as a function of the droplet vaporization rate. For low values of the ambient temperature, the curve giving the vaporization rate in terms of the Damkohler number is S shaped and, thus, exhibits ignition-extinction characteristics. The lower bend of the S curve correspond to a nearly frozen regime, under which ignition conditions occur due to the large temperature sensitivity of the reaction rate. The upper bend of the S Curve corresponds to a regime, where nearly complete decomposition of the reactant occurs when it reaches a thin reactive-diffusive zone, after crossing a transport zone. This zone becomes thin, and thus planar, for large Damkohler numbers, resulting in a droplet decomposition rate proportional its radius. For low ambient temperatures a segment of the curve between the two bends of the S curve corresponds to a regime of partial decomposition in a thin reaction zone. GRA

N75-33276# Thiokol Chemical Corp., Brigham City, Utah. Wasatch Div.
CHEMICAL STRUCTURAL AGING STUDIES ON AN HTPB PROPELLANT Final Report
L. H. Layton Apr. 1975 90 p refs
(Contract F04611-71-C-0049)
(AD-A010731; TWR-75065; AFRPL-TR-75-13) Avail: NTIS CSCL 21/9

An accelerated aging study has been performed with an HTPB (hydroxy terminated polybutadiene) propellant having formulation number TP-H1139. An aging model has been suggested to describe the aging effects on the chemical reaction kinetics in the binder and the resulting mechanical properties. The aging model has been used to make long time equivalent aging properties predictions from short time thermally accelerated aging results. To accomplish the development of an aging model, measurements were made to determine the reaction chemistry in the binder and the corresponding mechanical properties. It was necessary to separate the binder from the solids in the cured propellant and to perform chemical analyses on the sol and gel fractions of the binder. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N75-33277 Princeton Univ., N.J.
RAMAN SPECTRUM OF SOLID NITROGEN AT HIGH PRESSURES AND LOW TEMPERATURES Ph.D. Thesis
Fernando D. Medina 1975 136 p
Avail: Univ. Microfilms Order No. 75-23224

The Raman spectrum of the three known phases of solid nitrogen has been studied in the temperature range from 0 to 200 K and the pressure range from 0 to 10 Kbar. A novel method was used in that the sample was grown within a high pressure optical cell which constrained it to nearly isochoric conditions. This method allows the separation of temperature and volume effects. Two lines have been observed in the lattice region of the gamma-phase which are identified as Eg and B1g librational modes on the basis of frequency and relative intensity calculations. An asymmetrical line has been observed in the stretching region of this phase. Two very broad lines are found in the lattice region of the beta-phase. The low- and high-frequency lines are identified with translational and librational modes, respectively. Dissert. Abstr.

N75-33278*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SMOKE GENERATOR Patent Application
James R. Rogers, inventor (to NASA) Filed 1 Oct. 1975 21 p
(NASA-Case-ARC-10905-1; US-Patent-Appl-SN-618725) Avail: NTIS HC $3.25 CSCL 13K

A smoke generator is disclosed which is particularly suitable for mounting on the wing tips of an aircraft and for conducting airflow studies. The device includes a network of thermally insulated tubes for carrying a fluid which is used to produce smoke. The fluid, which need not be combustible, is heated above its vaporization temperature by electric current which is passed through the fluid conduit tubes, so that the tubes serve both as fluid conduits and resistance heating elements. Fluid supply and monitoring systems and electrical control systems are also disclosed. Author (NASA)

N75-33279# Office of Naval Research, Arlington, Va.
SYMPOSIUM ON NAVAL HYDRODYNAMICS (9TH). VOLUME 1: UNCONVENTIONAL SHIPS, OCEAN ENGINEERING
R. Brard and A. Castera 1972 1118 p Symp. held at Paris, 20-25 Aug. 1972
(AD-A010505; ONR-ACR-203-Vol-1) Avail: NTIS CSCL 13/10

The technical program of the Symposium was devoted to three subject areas of current naval and maritime interest. These subject areas are covered in the Proceedings in two volumes: Volume 1 -- The Hydrodynamics of Unconventional Ships, -- Hydrodynamic Aspects of Ocean Engineering, and Volume 2 -- Frontier Problems in Hydrodynamics. GRA

N75-33280# Office of Naval Research, Arlington, Va.
SYMPOSIUM ON NAVAL HYDRODYNAMICS (9TH). VOLUME 2: FRONTIER PROBLEMS
R. Brard and A. Castera 1972 904 p refs Symp. held at Paris, 20-25 Aug. 1972
(AD-A010506; ONR-ACR-203-Vol-2) Avail: NTIS CSCL 13/10

Volume 2 contains 19 papers on theoretical and applied problems in hydrodynamics. GRA

N75-33281# Science Applications, Inc., La Jolla, Calif.
EVALUATION OF NEUTRON AND PHOTON-PRODUCTION CROSS SECTIONS FOR NATURAL MAGNESIUM Final Report, 15 Mar. 1973 - 14 Mar. 1974
Marvin K. Drake and Martin P. Fricke 17 Jan. 1975 250 p refs
(Contract DNA001-73-C-0126; DNA Proj. NWED-QAXPC102)
(AD-A009940; SAI-74-561-LJ; DNA 3479F) Avail: NTIS CSCL 20/8

Data sources and methodologies used to prepare evaluated cross sections are described. Topics discussed include nuclear properties of magnesium, neutron cross sections, angular distributions of secondary neutrons, energy distributions of secondary neutrons, photoproduction, nuclear model parameters, uncertainty estimates, and impact of the experimental data. Author

N75-33282# National Bureau of Standards, Washington, D.C.
THE INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES 1875-1975 Final Special Publication
Chester H. Page and Paul Vigoureux May 1975 250 p refs Prepared in cooperation with Natl. Phys. Lab.
(COM-75-10631/0; NBS-SP-420) Avail: NTIS HC $7.50; HC also available from SOD as C13.10:420 CSCL 14B

Metrology - the science of measurement - is traced from man's earlier efforts to the world's most modern, uniform, and coherent measurement system, the International System of Units (SI). Detailed accounts are given of the 1875 Treaty of the Metre - to which 18 nations, including the United States, were signators - and the work of the International Bureau of Weights and Measures which was created by the Treaty and now the international province of 44 nations. Historical reviews are given

of the development of the base and derived units of the SI, specifically mass, length, gravimetry, manobarometry, thermometry, electricity, photometry, radioactivity, X and gamma rays, and neutron measurements. GRA

N75-33283# National Bureau of Standards, Washington, D.C.
DIMENSIONS/NBS, VOLUME 59, NUMBER 6, JUNE 1975
Jun. 1975 25 p
(COM-75-50141-06; NBS/DIM-59/6; LC-25-26527) Avail: NTIS MF $2.25; SOD HC available on subscription or per copy CSCL 05B

Short summaries of major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications are given. Topics discussed include: More on the Metric changeover; New insights on the causes of fire fatalities; Magnetohydrodynamics--an old idea with more power to it; You, the computer and our society in the next two decades; Mobile home safety, durability studies; Highlights; Bone cement characterized; Major appliance manufacturers support energy efficiency program; Hydrogen fuel topics published; Check energy labels on room air conditioners. GRA

N75-33284# Transit Development Corp., Washington, D.C.
METRIC CONVERSION AND THE TRANSIT INDUSTRY Final Report
David R. Phelps Jun. 1974 11 p refs
(PB-241848/1; TDC/500-74/5) Avail: NTIS HC $3.25 CSCL 14B

The mass transit industry will be affected by the transition to the metric system and must plan for it. The potential effects of metric conversion on the transit industry are discussed based on an assessment of the most probable course of action to be followed as an advocacy of metric conversion. GRA

N75-33285# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
STANDARD REFERENCE MATERIALS AND MEANINGFUL MEASUREMENTS Final Special Publication
Richard W. Seward Nov. 1973 821 p refs Presented at the 6th Mater. Res. Symp., Gaithersburg, Md., 29 Oct. - 2 Nov. 1973
(COM-75-10692/2; NBS-SP-408) Avail: NTIS HC $19.25; HC also available SOD as C13.10:408 CSCL 14B

The symposium was sponsored by the NBS Institute for Materials Research. The purpose of the symposium was to explore ways that standard reference materials (SRM's) could be used more effectively to bring about meaningful measurements both on a national and international scale, to explore the meaning of meaningful measurements, and to review the major paths now used to reach these measurements. Starting with the relationship of SRM's to a national measurement system, the symposium reviewed SRM activities at the international level, various national programs, and industrial needs. The use of statistics, selection criteria, and steps for certifying SRM's were reviewed. Fifteen panel sessions reviewed the current status of SRM's and outlined future needs. GRA

N75-33286# Pennsylvania State Univ., University Park. Applied Research Lab.
COMPUTERIZATION OF THE MEAN STREAMLINE BLADE DESIGN METHOD
Mark W. McBride 21 Feb. 1973 50 p refs
(Contract N00017-70-C-1407)
(AD-A011089; TM-73-22) Avail: NTIS CSCL 13/10

The mean streamline method of propulsor blade section design has been adapted to the digital computer. Results agree well with cases previously calculated by hand. The computer solution is rapid and will allow the designer to better optimize his blade shapes. Blade rotation, pre-swirl and sections on conical surfaces are accounted for by the program. Digital output from the program can be applied directly to hardware fabrication procedures without the time consuming digitizing and smoothing previously required. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N75-33287 Wisconsin Univ., Madison.
ELECTROMAGNETIC WAVE PROPAGATION OVER NON-UNIFORM SURFACE IMPEDANCE PLANES Ph.D. Thesis
Se Hyun Cho 1975 157 p
Avail: Univ. Microfilms Order No. 75-12891

The EM wave propagation over and radiation from nonuniform surface impedance planes are studied by numerical methods using integral formulations of the compensation theorem. The surface impedance is assumed to be a known factor and to only vary in the direction of propagation. These integral formulations are particularly used to investigate surface wave antennas, finite length sinusoidally modulated reactance surfaces (SMRS), and ground-wave propagation. The radiation characteristics of the surface wave antenna such as directivity, beam width, and side lobe level are discussed. Radiation from the finite length SMRS is investigated for various parameters which characterize the surface reactance, such as modulation amplitude, period, length of modulated section, and average surface reactance. The approximate radiation pattern is obtained analytically, and compares well with the radiation pattern found numerically. Dissert. Abstr.

N75-33288# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
ANALYSIS OF THE REQUIREMENT FOR AIR TRAFFIC CONTROL RADAR RESEARCH AND DEVELOPMENT
Kenneth E. Coonley Dec. 1974 14 p refs
(AD-A013348/8; FAA-RD-74-191) Avail: NTIS HC $3.25 CSCL 17/7

This report examines the role of radar in the Upgraded Third Generation ATC System relative to the surveillance requirement for various categories of controlled airspace. It concludes that the retention of ATC radars solely for weather data does not appear desirable in the long term and the possibility exists that development and deployment of radar systems specifically for the detection of weather may be required. Radar surveillance for ATC in the enroute environment may only be required at selected locations by the mid 1980's; therefore research and development efforts on enroute radars should be limited to that required to support the Operating Services in the correction of field problems. Radar surveillance for the terminal environment will be required at most locations on a continuing basis into the foreseeable future; therefore research and development of advanced terminal radar techniques and systems should be continued. Author

N75-33289*# Stanford Univ., Calif. Inst. for Plasma Research
REQUIREMENTS FOR SPACE SHUTTLE SCATTER RADAR EXPERIMENTS
K. J. Harker Oct. 1975 32 p refs Presented at URSI Meeting, Boulder, Colo., Oct. 1975
(Grant NGL-05-020-176)
(NASA-CR-119091; SU-IPR-643) Avail: NTIS HC $3.75 CSCL 17I

The feasibility of carrying out scatter radar experiments on the space shuttle was analyzed. Design criteria considered were the required average transmitter power, frequency resolution, spatial resolution, and statistical accuracy. Experiments analyzed were measurement of the naturally enhanced plasma line and the ion component of the incoherent scatter spectrum, and the plasma line artificially enhanced by an intense HF radio wave. The ion component measurement does not appear feasible, while the other two appear reasonable for short ranges only. Author

N75-33290# National Aviation Facilities Experimental Center, Atlantic City, N.J.
CHANNEL-LOSS DETECTOR FOR LOW-TRAFFIC TELETYPE CIRCUITS Final Report, Jan. 1973 - Oct. 1974
Charles Santora May 1975 30 p

(AD-A011681/4; FAA-NA-74-50; FAA-RD-75-1) Avail: NTIS HC $3.75 CSCL 17/2

A prototype device designed to detect teletype channel loss at international flight service stations by providing an idle signal in the absence of messages and activating alarms when continuity is disrupted or a failure occurs was described. Two such units were developed and evaluated at the National Aviation Facilities Experimental Center in accordance with requirements of the Systems Research and Development Service, Washington, D.C. and were found to perform satisfactorily. Each unit tested consisted of send and receive channel-loss detectors and teletypewriter circuit interfaces and associated alarms. As a digital device, the channel-loss detector may lend itself to other communication applications as needed. Author

N75-33291# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

ELECTRICAL GROUND IMPEDANCE MEASUREMENTS IN ALASKAN PERMAFROST REGIONS Final Report

Pieter Hoekstra Apr. 1975 67 p refs

(Contract DOT-FA74WAI-429)

(AD-A011458/7; FAA-RD-75-25) Avail: NTIS CSCL 20/14

Investigation was conducted to establish the techniques leading to construction of an electrical conductivity map of Alaska in the V/L/MF frequency band for use in planning of navigational aids. Results about ground conductivity in North America were available from geophysical studies near Fairbanks, from sites along the Alaska pipeline and in several areas of the Canadian Arctic; at these locations ground and/or airborne conductivity measurements were made by measuring the wavetilt and/or the surface impedance of radio groundwaves. Several difficulties were encountered in using ground conductivity data of high quality to construct a conductivity map of Alaska. They are: the results showed that the ground conductivity in permafrost areas of North America is very heterogeneous, so that it is not directly apparent how to assign an effective conductivity value to a path of practical length (approximately 100 km). The geological and permafrost conditions vary much in Alaska, so that measurements at a location are representative of a small area only, leaving large areas of Alaska open to question. Theoretical evaluations of the seasonal changes in ground conductivity and their effect on radiowave propagation and electrical grounding are also discussed. Author

N75-33292# Lincoln Lab., Mass. Inst. of Tech., Lexington.

SCALE MODEL PATTERN MEASUREMENTS OF AIRCRAFT L-BAND BEACON ANTENNAS

K. J. Keeping and J. C. Sureau 4 Apr. 1975 147 p refs

(Contract DOT-FA72WAI-261; FAA Proj. 034-241-012)

(AD-A010479/4; ATC-47; FAA-RD-75-23) Avail: NTIS HC $5.75 CSCL 09/5

The techniques and apparatus used to measure the directional patterns of aircraft ATC transponder antennas (L-band) with digital techniques and to store the data on magnetic tapes were described. Algorithms involved in data normalization, cross-polarization correction and coordinate conversions are discussed. Some typical applications of the data are illustrated with actual computer outputs obtained from the scale model measurements. Author

N75-33293# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).

THEORETICAL AND EXPERIMENTAL INVESTIGATION ON SIGNAL PROCESSING IN AN ADAPTIVE SPATIAL FILTER [THEORETISCHE UND EXPERIMENTELLE UNTERSUCHUNGEN ZUR SIGNALVERARBEITUNG IN EINEM ADAPTIVEN RAEUMLICHEN FILTER]

K. Kruecker and H. W. Bock Dec. 1974 61 p refs In GERMAN; ENGLISH summary

(Contract T/RF-32/RF-320/31067)

(Rept-3-74) Avail: NTIS HC $4.25

The possibilities and limitations of the so-called side-lobe canceller were demonstrated. The mathematical description of the control loops leads to various circuits from which the bandpass correlator loop is suggested because of its low drift and relatively simple realization. The interference suppression, defined as the ratio of interference power in the main channel to the total interference output power, is evaluated as a function of signal bandwidth, array antenna dimensions and decorrelation of the signals caused by different transfer functions in the receiver front end. The influence of the short-term correlation on the error and the influence of the real components on interference suppression and control loop stability were assessed. Additional simulation results and some experimental work show that, in the case of radar, it is possible to achieve 20 db of interference suppression with careful design of the control loops.

Author (ESA)

N75-33294# Dornier-System G.m.b.H., Friedrichshafen (West Germany).

SATELLITE COMMUNICATIONS FOR NORTH SEA OIL/GAS OPERATIONS. VOLUME 1: SUMMARY Final Report

P. Boese, K. D. Dalchow, H. Schuessler, comp., E. Velten, H. L. Cohrs (Standard Elektrik Lorenz A. G.), and P. F. Hein (Standard Elektrik Lorenz A. G.) Apr. 1974 102 p 2 Vol.

(Contract ESRO-SC/7/73-HQ)

(ESRO-CR(P)-514-Vol-1) Avail: NTIS HC $5.25

The applicability of satellite communications to oil/gas operations in the North Sea area was considered. Some trade-off analyses on specific areas were accomplished and a baseline system is proposed. The concept supposed to be economically most attractive uses digitized transmission techniques offering a large degree of flexibility and freedom for further optimization. Each earth terminal employing a 2.5 m parabolic antenna could be provided with a pair of uplink and downlink carriers operating in the 12 GHz band, PSK modulated by a convolutionally encoded binary data stream of 64000 bps. It is shown that this capacity is adequate to satisfy the needs of a typical offshore production complex. A single 20 W spacecraft repeater employing a 1.4 deg North Sea beam would suffice. This space segment could be a part of a multipurpose European communication satellite. Author (ESA)

N75-33295# Dornier-System G.m.b.H., Friedrichshafen (West Germany).

SATELLITE COMMUNICATIONS FOR NORTH SEA OIL/GAS OPERATIONS. VOLUME 2: SYSTEM ANALYSIS AND DEFINITION Final Report

P. Boese, K. D. Dalchow, H. Schuessler, comp., E. Velten, H. L. Cohrs (Standard Elektrik Lorenz A. G.), and P. F. Hein (Standard Elektrik Lorenz A. G.) Apr. 1974 274 p refs 3 Vol.

(Contract ESRO-SC/7/73-HQ)

(ESRO-CR(P)-515) Avail: NTIS HC $8.50

The applicability of satellite communications to oil/gas operations in the North Sea area was considered. Some trade-off analyses on specific areas were accomplished and a baseline system is proposed. The concept supposed to be economically most attractive uses digitized transmission techniques offering a large degree of flexibility and freedom for further optimization. Each earth terminal employing a 2.5 m parabolic antenna could be provided with a pair of uplink and downlink carriers operating in the 12 GHz band, PSK modulated by a convolutionally encoded binary data stream of 64000 bps. It is shown that this capacity is adequate to satisfy the needs of a typical offshore production complex. A single 20 W spacecraft repeater employing a 1.4 deg North Sea beam would suffice. This space segment could be a part of a multipurpose European communication satellite. Author (ESA)

N75-33296# Centre National d'Etudes Spatiales, Toulouse (France).

COMPUTATION AND PLOTTING OF SATELLITE ANTENNA GROUND COVERAGE [METHODE DE CALCUL ET TRACE DE ZONES DE COUVERTURE D'ANTENNE]

Claude Quere Jun. 1975 35 p In FRENCH; ENGLISH summary

(CNES-NT-15) Avail: NTIS HC $3.75

Using either conical or Mercator projection, continents and countries are plotted together with ground stations, curves of iso-power received at ground level, and curves of constant elevation coordinates of points of maximum received power as well as the principal axes of the satellite antenna assumed to be a paraboloid. ESA

N75-33297# Signals Research and Development Establishment, Christchurch (England).

A COMPUTER PROGRAM FOR THE SIMULATION OF STORE AND FORWARD TELEGRAPH NETWORKS
W. J. Cullyer, P. H. Masterman, and M. C. Butler Oct. 1974 47 p refs
(SRDE-73038; BR46207) Avail: NTIS HC $3.75

A description is given of a means of simulating the flow of telegraph messages through a network of store-and-forward switches. Messages may be multi-address and have any one of five levels of precedence. The modelling process is carried down to the level of individual subscribers. Buffers within the switches are represented in a simple manner but no other aspects of the internal operation of switches are modelled. The output facilities are comprehensive and include gross statistics, such as median delays for each level of precedence, as well as more detailed information. Author (ESRO)

N75-33298# Physics Lab. RVO-TNO, The Hague (Netherlands). Microwaves Dept.
X AND KU-BAND RADAR BACKSCATTER CHARACTERISTICS OF SEA-CLUTTER. PART 1: AN EXPERIMENTAL MODEL AND THE GRAZING ANGLE REGION OF 0.5 LESS THAN OR EQUAL TO PHI LESS THAN OR EQUAL TO 2 DEG, AT PULSE LENGTHS TAU EQUALS 0.5 MICROSEC
H. Sittrop Apr. 1975 40 p refs
(PhL-1975-08-Pt-1; TDCK-66261-Pt-1) Avail: NTIS HC $3.75

An experimental model describing the radar backscattering of sea clutter per unit area and the spectrum bandwidth as a function of grazing angle and wind velocity was developed. The model was based on measurements of the west coast of Norway conducted with a noncoherent measuring radar rigidly mounted on a rock 450 m above sea level, covering 180 deg of sea area. Parameters such as radar wavelength, polarization, and observation angle with regard to wind direction are incorporated in the model. The influence of the grazing angle on the radar cross section and the spectrum bandwidth is significant. The cross section increases with the wind velocity more at X-band than at Ku-band frequencies. ESA

N75-33299# Physics Lab. RVO-TNO, The Hague (Netherlands). Microwaves Dept.
X AND KU-BAND RADAR BACKSCATTER CHARACTERISTICS OF SEA-CLUTTER. PART 2: THE GRAZING ANGLE REGION OF 0.3 DEG LESS THAN OR EQUAL TO PHI LESS THAN OR EQUAL TO 6 DEG, AT PULSE LENGTHS TAU EQUALS 0.5 MICROSEC AND TAU EQUALS 0.12 MICROSEC
H. Sittrop Apr. 1975 28 p refs
(PhL-1975-09-Pt-2; TDCK-66292-Pt-2) Avail: NTIS HC $3.75

Investigations on the experimental radar backscattering model, show a validity for an extended grazing angle region between 0.3 and 6 deg, at pulse lengths 0.5 micro sec, and partly at 0.12 microsec. At pulse lengths of 0.12 microsec, a slow modulation is superimposed on the capillary mechanism, influencing the results for horizontal polarization. The model appears to be valid only for vertical polarization and presents an upper boundary for horizontal polarization. Due to the shortage of relevant data, the results obtained at shorter pulse lengths are considered as preliminary for the Ku-band and valid for a confined wind velocity region for the X-band. Author (ESA)

N75-33300# Harris Corp., Melbourne, Fla. Electronic Systems Div.
SPIRAPHASE: 16, VOLUME 1 Final Report, 2 Jan. - 31 May 1974
Kenneth M. Jagdmann and H. Richard Phelan 25 Jun. 1974 144 p 2 Vol.
(Contract DAAD07-72-C-0244)
(AD-A010343; Rept-6121-006-Vol-1) Avail: NTIS CSCL 17/9

The key objective of this development program was to prove the feasibility of applying the HARRIS Electronic Systems Division SPIRAPHASE reflectarray concept to modify the FPS-16 radar for multitarget capability. The goal of the effort was to design, develop, fabricate and test a small nontracking SPIRAPHASE reflectarray which would demonstrate the key advantages and performance capabilities of the SPIRAPHASE approach. GRA

N75-33301# Harris Corp., Melbourne, Fla. Electronic Systems Div.
SPIRAPHASE: 16, VOLUME 2 Final Report, 2 Jan. - 31 May 1974
Kenneth M. Jagdmann and H. Richard Phelan 25 Jun. 1974 101 p 2 Vol.
(Contract DAAD07-72-C-0244)
(AD-A010344; Rept-6121-006-Vol-2) Avail: NTIS CSCL 17/9

This report, Volume II of the Final Report, documents the work performed on SPIRAPHASE-16 for White Sands Missile Range from 1 July 1972 to 31 August 1973. The key objective of this program is to prove the feasibility of applying the HARRIS Electronic Systems Division (Harris ESD) proprietary SPIRAPHASE reflectarray concept to modification of FPS-16 radar systems for multiple target track capability. Topics discussed include the following: Overall array design; element design; diode switching circuit; driver circuits; integrated element design; polarizer electrical design; feed design; mechanical design; beam steering unit; and, test results. GRA

N75-33302# CNR, Inc., Newton Upper Falls, Mass.
EQUIVALENCE MEASUREMENT STUDIES (SECTIONS 1-4), VOLUME 1 Final Report, Apr. 1973 - May 1974
Phillip A. Bello, Louis A. Jankauskas, and Leslie W. Pickering Apr. 1975 371 p refs
(Contract F30602-73-C-0267)
(AD-A010004; RADC-TR-75-95-Vol-1) Avail: NTIS CSCL 17/2

The report describes the results of an investigation concerned with developing and evaluating concepts for channel quality monitoring of advanced digital data transmission techniques over four fading dispersive channels of interest to military communications: the line-of-sight ground point-to-point microwave relay, troposcatter, satellite ionospheric scintillation, and high-frequency long haul channels. The study emphasis is on a monitoring subsystem called the Media Quality Unit (MQU) which continually estimates long- and short-term error rates for a nondegraded receiver and by comparison with actual error rate as measured by a Performance Monitor Unit (PMU) allows estimation of receiver degradation trends and classification of outages into receiver-, media, or interference-caused. Major effort was devoted to development and analysis of MQU techniques which use the received information-bearing signal alone as a source of channel information since continuous one-line operation is possible and no special probing signals are required. GRA

N75-33303# CNR, Inc., Newton Upper Falls, Mass.
EQUIVALENCE MEASUREMENT STUDIES (SECTIONS 5-8 AND APPENDIXES A, B AND C, VOLUME 2 Final Report, Apr. 1973 - May 1974
Phillip A. Bello, Louis A. Jankauskas, and Leslie W. Pickering Apr. 1975 170 p refs
(Contract F30602-73-C-0267)
(AD-A010005; RADC-TR-75-95-Vol-2) Avail: NTIS CSCL 17/2

Contents: Error rate estimation utilizing channel measurements based upon received signals alone; Techniques utilizing special probing signals; Gross channel parameter estimation from bias uncorrected estimates; Determination of bias in estimating the branch envelope correlation coefficient; Minimization of the RMS error in estimating the absolute value of (T(f,t)) squared conditional upon the fade level. GRA

N75-33304# Clarkson Coll. of Technology, Potsdam, N.Y.
DISCRETE-CONTROL CORRECTION: A TECHNIQUE FOR THE SYNCHRONIZATION OF DIGITAL COMMUNICATION NETWORKS
Rangaswamy Mukundan, David A. Perreault, Komandur R. Krishnan, and Robert F. Cotellessa Mar. 1975 67 p refs
(Contract F30602-72-C-0463; AF Proj. 9567)
(AD-A009874; RADC-TR-75-83) Avail: NTIS CSCL 17/2

In a digital communication network the transmission and detection of digital data at each node is controlled by a local clock which supplies the reference timing. Each node also uses buffers on its incoming links to allow for delay and frequency variations. If all the clocks are not in synchronism there will be an eventual overflow or depletion of some of the buffers causing

loss of information and hence it is desirable to have the clocks run synchronously. This will also lead to minimizing of buffer capacities. This work examines a method of synchronizing nodal clocks in which periodic corrections are made to each clock based upon changes in local buffer levels. Conditions are derived under which synchronization can be achieved. Explicit formulae have been derived for the frequency of synchronism and steady-state buffer levels. It is further shown that in case of failures of some of the nodes the remaining subnetwork or networks attain synchronism by themselves. All the theoretical results have been verified by software simulation as well as actual hardware implementation. GRA

N75-33305# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INTERMODULATION PRODUCTS OF A UHF DIPLEXER
Joseph C. Lee 21 Oct. 1974 19 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-A001583; TN-1974-56; ESD-TR-74-289) Avail: NTIS CSCL 17/2

The report describes a two-month effort to investigate spurious intermodulation noise problems generated by various UHF transmitting channels planned for the FLTSATCOM satellite. The prime consideration was to design and build a diplexer with minimum intermodulation products and to measure the third-order intermodulation level. The design goal was to hold the third-order intermodulation below -145 dBm when two transmitters deliver 30 watts to the diplexer. A level below -125 dBm was actually achieved in the time available. GRA

N75-33306# University of Southern Calif., Los Angeles.
TELECOMMUNICATIONS-TRANSPORTATION TRADEOFFS Final Report, 1 Jul. 1973 - 31 Dec. 1974
Jack M. Nilles, Frederick R. Carlson, Paul Gray, and Gerhard Hanneman Dec. 1974 237 p refs
(Grant NSF GI-39019)
(PB-241871/3; NSF/RA/S-74-020) Avail: NTIS HC $7.50 CSCL 17B

The implications are evaluated of potential communications and computer technology alternatives to urban transportation, particularly the commute to work. Three criteria for successful telecommunications alternatives to transportation were used to evaluate the feasibility of telecommuting in various situations. These criteria are: (1) economic benefits, (2) adequate technological base, (3) semantic and psychological effectiveness. Emphasis was placed on the utility of telecommuting in the information industry. It is concluded that existing and near term technologies provide a suitable economic basis for allowing organizations to decentralize using telecommuting. Potential impacts on energy consumption, transportation and urban development are discussed. GRA

N75-33307# Aerospace Corp., El Segundo, Calif.
93-GHz RADAR CROSS-SECTION MEASUREMENTS OF SATELLITE ELEMENTAL SCATTERERS
Robert B. Dybdal and Howard E. King 10 Apr. 1975 37 p refs
(Contract F04701-74-C-0075)
(AD-A010487; TR-0075(5230-40)-4; SAMSO-TR-75-127) Avail: NTIS CSCL 17/9

The radar cross sections of representative spacecraft materials and components were measured at 93 GHz. Measurements of solar cells, thermal blanket material, structural components, and sensors are included. These measurements indicate the highly specular nature of scattering at millimeter wavelengths. The measurements generally agree with results predicted on the basis of common asymptotic formulations. GRA

N75-33308# Office of Telecommunications, Boulder, Colo.
CONFIDENCE LIMITS FOR DIGITAL ERROR RATES
Edwin L. Crow Nov. 1974 74 p refs
(COM-75-10793/8; OTR-74-51) Avail: NTIS MF $2.25; SOD HC CSCL 17B

Confidence limits for error rates (probabilities of an error) of digital communication systems are derived and implemented under the assumptions that the error rate is constant and the trials are independent. Four types of samples are considered: prescribed sample size (binomial sampling), prescribed number of errors (inverse binomial sampling), both sample size and number of errors bounded (truncated binomial sampling), and truncated binomial sampling with sample size also bounded below. Both exact confidence limits and good approximations for them in the communications situation of small error rates are presented. Point as well as interval estimates are presented. The planning of the experiment is discussed. GRA

N75-33309# Technische Hochschule, Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik.
MODE CONVERSION AND SINGLE MODE EXCITATION IN THE EARTH-IONOSPHERE WAVEGUIDE WITH ARBITRARY TERRESTRIAL MAGNETIC FIELD Final Technical Report, 1 Jan. - 31 Dec. 1974
Ernst Ledinegg Jan. 1975 97 p refs
(Contract DAJA37-74-C-1426; DA Proj. 200-61102-B-31E)
(AD-A010780) Avail: NTIS CSCL 20/14

The present Final Report contains the continuation and extension of investigations on the propagation of electromagnetic VLF waves in polar regions. The extension considered in this report concerns mainly the terrestrial magnetic field. Part I is devoted to general theoretical considerations. It deals with the derivation of a fictitious surface impedance of the plane ionospheric boundary which mimics the influence of the ionosphere on wave propagation through the atmosphere. In Part II the surface impedance derived in Part I is applied to two waveguide models, the plane two-dimensional and the cylindrical model. In Part III the possibilities for suppressing or favouring the excitation of certain modes in the earth-ionosphere waveguide by a suitable antenna array are discussed. GRA

N75-33310# Naval Surface Weapons Center, White Oak, Md.
THE SCATTERING OF ELECTROMAGNETIC RADIATION BY APERTURES. 5. SURFACE CURRENT, TANGENTIAL APERTURE ELECTRIC FIELD, AND BACK-SCATTERING CROSS-SECTION FOR THE AXIALLY SLOTTED CYLINDER AT NORMAL, SYMMETRIC INCIDENCE
J. N. Bowbardt, Jr. and L. F. Libelo Apr. 1975 197 p refs
(AD-A011050; NSWC/WOL/TR-75-39) Avail: NTIS CSCL 20/14

The report considers the thin-walled perfectly conducting, axially slotted, infinite circular cylinder, and the infinite cylindrical strip. For the case of incidence simultaneously normal to the cylinder axis and parallel to the symmetry plane bisecting the infinite axial slot, it presents the analytical formulation of the integral equations for the surface current on the conductor and also those for the tangential component of the electric field over the slot. The incident radiation is assumed merely for simplicity to be monochromatic, plane, and linearly polarized parallel to the cylinder axis. GRA

N75-33311# Naval Research Lab., Washington, D.C.
SAMPLING WIDEBAND NONREPETITIVE RADAR SIGNALS Interim Report
A. M. Findlay and E. Ornstein 21 May 1975 25 p refs
(NRL Proj. R02-24)
(AD-A011037; NRL-7859) Avail: NTIS CSCL 17/9

Serial sampling of wideband radar signals in the manner of a sampling oscilloscope will provide inaccurate results to the extent that the signal is changing during the course of the sampling process. An ideal but expensive solution to the problem is parallel sampling. A compromise approach is parallel-serial sampling, which combines the two techniques. A parallel-serial sampling system was developed at NRL and operates as part of the High Range Resolution Monopulse (HRRM) Radar. GRA

N75-33312# RAND Corp., Santa Monica, Calif.
SCIENCE ON TELEVISION: ALTERNATIVES TO BROADCASTING
Walter S. Baer Jan. 1975 10 p refs
(AD-A010971; P-5305) Avail: NTIS CSCL 17/2

The report discusses alternatives to conventional broadcast television and their usage. These developments include new microwave and satellite networks for distributing video programs, cable television, video recording and playback equipment, and closed circuit systems. GRA

N75-33313# Naval Electronics Lab. Center, San Diego, Calif.
THE EFFECT OF THE EVAPORATION DUCT ON MICROWAVE PROPAGATION Technical Report, 1 Jul. 1969 - 30 Jun. 1973
J. H. Richter and H. V. Hitney 17 Apr. 1975 36 p refs
(NELC Proj. M108; SF1214014)
(AD-A011052; NELC-TR-1949) Avail: NTIS CSCL 20/14

An analytical and experimental program is described to assess the effect of evaporation ducting on radio propagation. Extensive meteorological and radio propagation measurements were conducted and checked against computer calculations. Particular emphasis was given to the influence of antenna height on detection range under a variety of ducting conditions. A computer program has been developed which models radio propagation in the evaporation duct using mode theory. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N75-33314 Polish Academy of Sciences, Warsaw.
RADIATION OF AN ELECTRIC DIPOLE MOVING IN A MEDIA WITH FREQUENCY-SPATIAL DISPERSION [PROMIENIOWANIE DIPOLA ELEKTRYCZNEGO PORUSZAJACEGO SIE W OSRODKU Z DYSPERSJA CZASOWO-PRZESTRZENNA]
Nadiezda Bobrowa 28 Feb. 1975 20 p refs In POLISH
Avail: Issuing Activity

Electric dipole radiation in an isotropic, homogeneous, infinite media was investigated. Expressions were obtained on an oblong and lateral field in a remote zone for the electric dipole oriented parallel to motion velocity. The field was determined for the nonrelativistic motion velocity of the dipole and time dispersion was used. Transl. by M.J.S.

N75-33315 Polish Academy of Sciences, Warsaw.
ELECTROMAGNETIC FIELD OF A LINEAR PHASE SOURCE IN A UNIAXIAL ANISOTROPIC SPACE [POLE ELEKTROMAGNETYCZNE SFAZOWANEGO ZRODLA LINIOWEGO W PRZESTRZENI JEDNOOSIOWO ANIZOTROPOWEJ]
Jan Krzysztof Frackowiak 27 Feb. 1975 29 p refs In POLISH
Avail: Issuing Activity

Asymptotic expressions were found for electromagnetic fields, radiated through phased linear source in a nonloss uniaxial anisotropic space. Topics discussed include superpotential method, Fourier transformation, electromagnetic wave excitation, Maxwell equation, and electric fields. Transl. by M.J.S.

N75-33316 Polish Academy of Sciences, Warsaw.
NONLINEAR RESONANCE IN TRANSMISSION LINES [NIELINIOWY REZONANS W LINII TRANSMISYJNEJ]
Halina Kudrewicz 27 Mar. 1975 46 p refs In POLISH
Avail: Issuing Activity

The connection of nonlinear resonance in transmission lines loaded with nonlinear inductance was investigated. First harmonic approximation method (the functional description method) was used for the investigation. It was found that in the environment of such frequencies, the cyclic solution is heterogenous. The current amplitude curve at the end of the line in the frequency function has the form typical for nonlinear resonance known in nonlinear electrical or mechanical systems. Transl. by M.J.S.

N75-33317 Florida Univ., Gainesville.
NOISE IN JUNCTION-GATE FIELD-EFFECT TRANSISTORS AT LOW TEMPERATURES Ph.D. Thesis
Clifford Frederick Hatt 1974 157 p
Avail: Univ. Microfilms Order No. 75-19344

At room temperatures the limiting noise in junction-gate field-effect transistors is the thermal noise in the channel. At cryogenic temperatures the limiting noise is generation-recombination noise occurring in the depletion region and in the conducting channel. Special JFET devices were made which have very low pinch-off voltages, high transconductance, and low saturated drain current to facilitate a closer examination of the g-r noise problem. The results are presented of a detailed noise study of these devices, and results are compared with those obtained from measurements on commercially made JFETs. The results obtained indicate a departure from classical theory when channel thickness is very small. Further investigation is recommended and suggestions for further study are made.
Dissert. Abstr.

N75-33318 Florida Univ., Gainesville.
OPTIMIZATION OF NONLINEAR PERIODIC CIRCUITS Ph.D. Thesis
Karl Wayne Current 1974 122 p
Avail: Univ. Microfilms Order No. 75-19322

Optimization algorithms for the design of nonlinear periodic circuits are developed. These algorithms require the appropriate combination of network simulation techniques and a performance function minimization strategy. Each algorithm is based upon a different definition of the set of designable parameters to be varied in the minimization of the performance function. In the first algorithm the parameter space consists only of the set of designable resistors, capacitors, and inductors in the network. In the second algorithm, the parameter space is made up of both these designable network parameters and the network initial conditions. Examples illustrate the application of these optimization algorithms to the design of forced nonlinear periodic circuits.
Dissert. Abstr.

N75-33319*# Scientific Translation Service, Santa Barbara, Calif.
ELECTROMETRIC AMPLIFIER WITH INTERMITTENT FEEDBACK
A. I. Valilyeva and N. K. Smirnov Washington NASA Oct. 1975 11 p ref Transl. into ENGLISH from Russian Report PR-219, Acad. of Sci. USSR, Inst. of Space Res. (Moscow), 1975 p 1-10
(Contract NASw-2791)
(NASA-TT-F-16602; PR-219) Avail: NTIS HC $3.25 CSCL 09C

Direct current amplifiers, which employ field-effect transistors with a differential system, have a comparatively large temperature drift and a zero time drift; this makes it impossible to realize the possibilities of these amplifiers. A variation was examined which uses intermittent drifts of a feedback to decrease the temperature drifts and the zero time differential amplifier.
Author

N75-33320*# College of William and Mary, Williamsburg, Va.
STABILITY OF MULTIRATE SAMPLED-DATA SYSTEMS Topical Report, 10 Nov. - 16 Aug. 1974
David P. Stanford and Alper K. Caglayan Washington NASA Oct. 1975 33 p refs
(Contract NAS1-11958)
(NASA-CR-2589) Avail: NTIS HC $3.75 CSCL 09C

Current adaptive sampling schemes that can be used in sampled-data systems with variable rate sampling does not guarantee the stability of the resulting closed-loop system. A study was undertaken with the objective of finding a stable control law for multirate sampled-data systems. The problem is formulated such that the sampling interval is selected from a set of fixed number of sample intervals. A necessary and sufficient condition under which these types of systems can be stabilized is given. For a certain subclass of these types of systems, a sampling selection algorithm is given which results in a stable closed-loop system. Author

N75-33321# Waterloo Univ. (Ontario). Dept. of Electrical Engineering.
CHARACTERIZATION OF TIME-INVARIANT NETWORK ELEMENTS
Y-F. Lam 29 Jan. 1974 16 p refs
(UWEE/74-1) Avail: NTIS HC $3.25

A discussion is presented on the definitions and characterizations of the four basic types of time-invariant electrical network

elements. Namely, resistors, inductors, capacitors and memristors, including the nonlinear multiport cases are discussed. Author

N75-33322*# Kanner (Leo) Associates, Redwood City, Calif.
EVALUATION OF THE ENERGY CHARACTERISTICS OF NONSTATIONARY BROADBAND RANDOM PROCESSES ACCORDING TO INDIVIDUAL REALIZATIONS
G. F. Telenin and F. V. Podsypanin Washington NASA Oct. 1975 94 p refs Transl. into ENGLISH from Sci. Trans. (Moscow), no. 26, 1973 p 1-67
(Contract NASw-2790)
(NASA-TT-F-16567) Avail: NTIS HC $4.75 CSCL 09C

Based on theory of generalized functions, connections between uniform (in the broad sense) processes and white noise are developed and applied to development of theory of estimation of intensity according to individual realizations. Computer modeling of nonstationary random processes is discussed, similar transformations of wideband processes is reviewed and basic calculation formulas are developed. Use of a modified fast Fourier transform algorithm is considered. Specific recommendations and rules are then proposed for practical use of the methods developed. Author

N75-33323*# ARTCOR, Costa Mesa, Calif.
HIGH TEMPERATURE ELECTRICALLY CONDUCTING CERAMIC HEATING ELEMENT AND CONTROL SYSTEM
Carl R. Halbach and Russell J. Page Jun. 1975 91 p refs
(Contract NAS8-29769)
(NASA-CR-143983) Avail: NTIS HC $4.75 CSCL 09C

Improvements were made in both electrode technology and ceramic conductor quality to increase significantly the lifetime and thermal cycling capability of electrically conducting ceramic heater elements. These elements were operated in vacuum, inert and reducing environments as well as oxidizing atmospheres adding to the versatility of the conducting ceramic as an ohmic heater. Using stabilized zirconia conducting ceramic heater elements, a furnace was fabricated and demonstrated to have excellent thermal response and cycling capability. The furnace was used to melt platinum-20% rhodium alloy (melting point 1904 C) with an isothermal ceramic heating element having a nominal working cavity size of 2.5 cm diameter by 10.0 cm long. The furnace was operated to 1940 C with the isothermal ceramic heating element. The same furnace structure was fitted with a pair of main heater elements to provide axial gradient temperature control over a working cavity length of 17.8 cm.
Author

N75-33324*# National Aeronautics and Space Administration, Washington, D.C.
ELECTRICAL AND ELECTRONIC DEVICES AND COMPONENTS: A COMPILATION Technology Utilization
May 1975 29 p
(NASA-SP-5971(01)) Avail: NTIS HC $1.00 CSCL 09A

Components and techniques which may be useful in the electronics industry are described. Topics discussed include transducer technology, printed-circuit technology, solid state devices, MOS transistors, Gunn device, microwave antennas, and position indicators. M.J.S.

N75-33325# Waterloo Univ. (Ontario). Dept. of Electrical Engineering.
COMMENT ON MODELING OF THREE TERMINAL DEVICES: A BLACK BOX APPROACH
Y-F. Lam 29 Jan. 1974 10 p refs Sponsored by Natl. Res. Council of Canada
(UWEE/74-3) Avail: NTIS HC $3.25

Comments on a previous document dealing with the modelling of three terminal devices were presented. It was shown that x-controlled concave and convex resistors can be realized by ideal diodes, two-terminal resistors (linear and nonlinear), and linear controlled sources. From a circuit theoretic point of view, piecewise-linear three terminal elements can be modelled by ideal diodes, linear resistors, independent sources, linear controlled sources, and square law devices. Y.J.A.

N75-33326# European Space Research and Technology Center, Noordwijk (Netherlands).
NOISE LIMITATIONS IN IMAGE PICK-UP TUBES
H. H. Samuelsson Paris ESA Mar. 1975 24 p
(ESRO-TN-123-ESTEC) Avail: NTIS HC $3.25

The limiting performance of image pick-up tubes (TV cameras) for scientific applications was calculated. The noise sources considered include photon noise, uniform dark emission of electrons and ions, and preamplifier noise. The performance parameters treated as a function of resolution element area are the minimum detectable intensity and photometric measurement accuracy, when the investigated object is a point source, and the minimum detectable contrast and photometric accuracy, when a full gray-scale image is observed. It is shown that high gain in the tube is not always a desirable feature when dim objects are observed, unless the tube or the observational conditions only permit a short image-integration period. The influence of the amplifier noise can be minimized by selecting the read-out scan rate properly. Author (ESA)

N75-33327# Royal Aircraft Establishment, Farnborough (England).
AN INSTRUMENT FOR THE RAPID REMOVAL OF dc LEVELS WITH MINIMUM ac ATTENUATION OF VERY LOW FREQUENCIES
G. R. Sutton and R. H. Stanford Jan. 1975 17 p refs
(RAE-TR-75005; BR46323) Avail: NTIS HC $3.25

An ac amplifier with automatic adjustment of the input time constant to suit the signal frequency was developed. A dc component is removed from the ac signal within four cycles and the ac component attenuated by less than 25% over the design frequency range of 0.1 to 5 Hz. Author (ESA)

N75-33328# Physics Lab. RVO-TNO, The Hague (Netherlands). Microwaves Dept.
A GENERAL METHOD FOR CALCULATING THE CHARACTERISTICS OF MICROSTRIP TRANSMISSION LINES
W. P. M. N. Keizer Mar. 1975 71 p refs
(PhL-1975-04; TDCK-66014) Avail: NTIS HC $4.25

A general method is proposed for analyzing the propagation characteristics of microstrip transmission lines within a transverse electromagnetic wave approximation. These transmission lines are characterized by conducting strips, large groundplanes, dielectric layer insulation, and planar geometry. The method is based on the Green's function integral approach for formulating the problem. Numerical results were obtained by solving the integral equation using the subinterval method. Numerical results are presented for single and coupled microstriplines. A synthesis procedure is described which gives the geometry of a pair of coupled microstrip lines that corresponds to prescribed electrical properties. Further application is made to the design of PIN diode phase shifters and for active phased array modules. Computer programs written in FORTRAN IV are included.
Author (NSA)

N75-33329# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
IMPACT OF SAW FILTERS ON RF PULSE FREQUENCY MEASUREMENT BY DOUBLE DETECTION Physical Sciences Research Papers
K. R. Laker and A. J. Slobodnik, Jr. 6 Jan. 1975 197 p refs
(AF Proj. 6096)
(AD-A011603; AFCRL-PSRP-621; AFCRL-TR-75-0011) Avail: NTIS CSCL 09/5

When it is desired to measure the frequency of RF pulses to within a resolution comparable to the pulse spectral width, special techniques must be adopted. Double detection is such a method. The report presents a simplified mathematical model of the double detection frequency measurement technique. Both frequency and time domain (through the use of an FFT routine) responses of the two individual filters are considered along with the difference of the squares of the time domain responses. Good agreement between theory and experiment is shown. The model includes gating and thresholding and the effects of these parameters are investigated. A complete computer program description, listing, and test case are given. This model can be used to optimize the parameters of a double-detection system. Finally, the model has been used to evaluate the double detection performance of a variety of filter responses including Butterworth, flat exponential filter, brick wall, Kaiser truncated sinx/x, Hamming, and Gaussian. GRA

N75-33330# Naval Surface Weapons Center, White Oak, Md.
ANALYSIS OF A HIGH-SPEED KERR-MAGNETO-OPTIC DETECTION SCHEME FOR CROSSTIES Progress Report, Aug. - Dec. 1974
K. P. Scharnhorst, L. J. Schwee, and O. J. VanSant, Jr. 11 Feb. 1975 64 p refs
(AD-A010124; NSWC/WOL/TR-75-23) Avail: NTIS CSCL 09/2

An analysis of an integrated Kerr-magneto-optic modulator based on partially transparent gyroelectric permalloy films is given. This device was originally proposed in conjunction with a readout scheme for crosstie-Bloch line pairs in a crosstie memory. The problem of integrating a wave guide modulator having weakly or strongly absorbing (ferromagnetic) walls in the form of thin gyroelectric films on non-absorbing dielectric substrates, with an isotropic, non-absorbing, dielectric wave guide is analyzed. Computer generated curves are presented, which show the angle of incidence and film thickness dependence of the longitudinal Kerr-reflection coefficient and of the figures of merit for magneto-optic modulation by thin permalloy films sandwiched between different dielectrics. GRA

N75-33331# Texas Univ., Austin. Electronics Research Center.
TEXAS BIANNUAL OF ELECTRONICS RESEARCH NUMBER 20 Interim Report, 1 Apr. - 30 Sep. 1974
Arwin A. Dougal 15 Nov. 1974 291 p refs
(Contract F44620-71-C-0091; AF Proj. 4751)
(AD-A010483; AFOSR-75-0670TR) Avail: NTIS CSCL 09/3

The Twentieth Biannual includes recent findings, research investigations, progress reports, and future plans in the areas of Solid State Electronics, Information Systems, Plasma and Quantum Electronics, Bio-Medical Electronics, and Acoustics and Radio Sciences. GRA

N75-33332# Radio Corp. of America, Somerville, N.J. Solid State Div.
IMPROVED RADIATION HARDNESS OF BIPOLAR LINEAR CIRCUITS Interim Report, 15 Jul. 1974 - 15 Feb. 1975
Faith Lee May 1975 57 p refs
(Contract N00014-74-C-0451)
(AD-A010224; PRRL-75-CR-10) Avail: NTIS CSCL 09/5

Because of the excellent initial response of the CA108A differential amplifier to radiation, it was thought that this device could be made even more radiation-resistant by use of ultra-clean processing. Several groups of amplifiers were characterized, and a baseline was drawn for further work on process variations. A test cell was designed to aid in process control. A group of wafers was split into four lots with one stabilizing processing step changed to pinpoint which step is the most important. Present data indicates the devices are stable even with process changes. The conclusion is that ultraclean processing may further stabilize and improve the radiation hardness of the CA108A amplifier. GRA

N75-33333# Ohio State Univ., Columbus. ElectroScience Lab.
AN EXPERIMENTAL INVESTIGATION OF THE T-BAR FED SLOT ANTENNA ON PLANAR AND CYLINDRICAL SURFACES
Michael R. Crews Mar. 1975 80 p refs
(Contract N00140-75-C-6116)
(AD-A010864; ESL-4111-1) Avail: NTIS CSCL 09/5

The report describes the results of an intensive experimental effort directed toward the electrical improvement and size reduction of slot antennas. In particular, the T-bar fed cavity backed slot antenna mounted on both a planar surface and also transversely mounted on a circular cylinder are investigated over the four to one frequency bandwidth of 500 to 2000 MHz. GRA

N75-33334# Illinois Univ., Urbana. Coordinated Science Lab.
DESIGN OF TOTALLY SELF-CHECKING ASYNCHRONOUS SEQUENTIAL MACHINES Ph.D. Thesis
Fusun Ozguner May 1975 123 p refs
(Contract DAAB07-72-C-0259)
(AD-A010719; R-679; UILU-ENG-75-2214) Avail: NTIS CSCL 09/5

Properties of state assignments and circuit realizations that lead to totally self-checking asynchronous machine designs are studied. The state variables and the outputs are encoded so that all single and unidirectional faults cause the machine to assume a noncode state or output. Several state assignment methods are presented. One is the two-rail assignment where the feedback lines are checked with a two-rail checker tree. It is shown that any two-rail checker cannot be used because the state assignment does not in general have all the two-rail codewords. Therefore a checker tree that can be checked by the state assignment code must be selected. An algorithm for finding such a tree is presented. The effect of a fault on the encoded outputs is studied. A self-checking circuit produces a noncode output for at least one code space input. It is shown that a self-checking asynchronous machine will produce a noncode output for at least one input sequence which occurs under normal operation. For this design, the destination sets of each input column of the flow table are encoded with a constant weight or another unordered code. Redundancies in the code and in the realization are discussed. It is shown that extra outputs can be used for the detection of primary input faults and for a class of flow tables for faster fault detection. GRA

N75-33335# California Inst. of Tech., Pasadena.
NUMERICAL SIMULATION OF CHARGE COUPLED DEVICE OPERATION, ABBREVIATED FORM Final Report
A. M. Mohsen, Y. Diamon, and C. A. Mead 31 Oct. 1974 5 p refs
(Contract N00014-67-A-0094-0032)
(AD-A010915; FR-2) Avail: NTIS CSCL 09/1

The research consisted of a detailed theoretical study of the operation of both surface and buried channel charge coupled devices (CCD). In the case of surface charge coupled devices, the primary results were: the development of the technologically important push clock clocking scheme, the numerical simulation of the operation of two and four phase overlapping gate CCD, the estimation of the importance of interface states in limiting the charge transfer for a number of different clocking schemes, the estimation of the small signal or long time decay of the charge in surface channel CCD. In the case of buried channel CCD (BCCD), the primary results were: the development of detailed one and two dimensional solutions for the electrostatics of overlapping gate BCCCD, and the numerical simulation of the details of the operation of BCCCD. Finally, a new CCD device structure was explored, the Schottky barrier CCD. This new device structure may have potential applications in the manufacture of CCD in materials other than silicon. GRA

N75-33336# Stanford Univ., Calif. Microwave Lab.
ACOUSTICALLY SCANNED IMAGE Semiannual Report, 1 Aug. 1974 - 31 Jan. 1975
Gordon S. Kino Feb. 1975 78 p refs
(Contract N00014-67-A-0112-0084; ARPA Order 2778)
(AD-A010913; SU-ML-2410; SAR-1) Avail: NTIS CSCL 09/5

The report describes work on a new type of optical scanning device which makes use of acoustic surface waves to scan an optical image. The device employs a silicon semiconductor as the photodector; the nonlinear interaction of two acoustic surface waves, whose electric fields interact with the silicon is employed in the basic mechanism of detection. Work on the airgap Si-LiNbO3 convolver configuration which is employed in this optical imaging device is described. Described is the theoretical development of the semiconductor convolver theory. Development of the technology of the ZnO on Si convolver configuration for use in the optical imaging device is discussed. A short description is given of a chirp generator, which was constructed for use in transform coding in these types of devices. GRA

N75-33337# Oak Ridge National Lab., Tenn.
POWER SYSTEM EMP PROTECTION Final Report
James H. Marable, Paul R. Barnes, and David B. Nelson Mar. 1975 73 p refs
(Contract W-7405-eng-26)
(AD-A010801; ORNL-4958) Avail: NTIS CSCL 09/3

The report contains a parametric study of EMP (Electromagnetic Pulse) power line surges and discusses protective measures to minimize their effects. Since EMP surges have considerably

greater rates of rise than lightning surges, recommended standards and test procedures are given to assure that surge arresters protect equipment from damage by EMP. Expected disturbances and damage to power systems are reviewed, and actions are presented which distribution companies can take to counter them. These include backup communications methods, stockpiling of vulnerable parts, repair procedures, and dispatcher actions to prevent blackout from EMP-caused instabilities. A long-range program is presented for improving distributors: protection against EMP. This involves employee training, hardware protection for power and control circuits, and improvement of plans for emergency action. GRA

N75-33338# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
EXACT AND QUASI-OPTIC DIFFRACTION WITHIN A CONCAVE CYLINDER Final Report, Jan. 1973 - Aug. 1974
Wasyl Wasylkiwskyj Aug. 1974 85 p refs
(Contract DAHC15-73-C-0200)
(AD-A010557; P-1054; IDA/HQ-74-16558) Avail: NTIS CSCL 09/5

This report presents a detailed analytical treatment of the surface current distribution induced by a line source on a concave cylindrical surface. The numerical and analytical results provide quantitative estimates of mutual coupling in conformal arrays on concave surfaces. GRA

N75-33339# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LOSSES IN A PERIODICALLY GAPPED CABLE ARMOR IN CONTACT WITH THE SURROUNDING SOIL
Michael L. Burrows 25 Apr. 1975 33 p refs Sponsored in part by Naval Electron Systems, Washington D. C.
(Contract F19628-73-C-0002; AF Proj. 1511)
(AD-A010592; TN-1975-21; ESD-TR-75-165) Avail: NTIS CSCL 09/1

A variational method is presented for evaluating the effective impedance of the periodically gapped armor on a buried cable. The armor is assumed to be in direct contact with the surrounding soil, so that the gaps, which are intended to break the longitudinal electrical conductivity, are in fact electrically bridged by the soil. From the effective impedance can be calculated the armor losses and, when the cable is used as a buried antenna, the reduction in antenna efficiency. Numerical results are presented graphically, and some corroborating experimental evidence is reported. GRA

N75-33340# Illinois Univ., Urbana. Coordinated Science Lab.
EFFECT OF PROCESSING AND SPECIAL COMPOSITIONAL VARIATIONS ON THE MICROSTRUCTURAL AND ELECTRICAL BEHAVIOR IN THE LEAD ZIRCONATE TITANATE SYSTEM
Apr. 1975 84 p refs
(Contract DAAB07-72-C-0259)
(AD-A010729; R-678; UILU-ENG-75-2213) Avail: NTIS CSCL 09/1

Recently lead zirconate titanate compositions (because of their high electro-mechanical coupling and polycrystalline nature) have been employed as substrates for interdigitally poled transducers. A desire was expressed to try to further develop a ceramic which could be readily polished and poled; in addition to exhibiting characteristics which would make it suitable for a (surface acoustic wave) SAW device (more specifically, low power loss over the operating frequency, high coupling, and relatively small grain size). The base composition was selected from the work done by Haertling and Land on the ternary system La-PbZrO2-PbTiO2 to achieve an optimization of dielectric constant, coercive field, planar coupling and remnant polarization. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N75-33341 Virginia Univ., Charlottesville.
MEASUREMENT OF PARTICLE DIFFUSION IN A TURBULENT JET BY LASER LIGHT-SCATTERING Ph.D. Thesis
Edward Joseph Shaughnessy 1975 134 p
Avail: Univ. Microfilms Order No. 75-22127

A laser light-scattering system was constructed which measures the instantaneous particle concentration in a turbulent flowfield. The light scattered from an incident laser beam by small particles seeded in the flowfield is collected by a lens and passed to a detector which measures the light intensity. A theoretical analysis of the scattering process and the resulting detector response is presented, and the various noise sources are described. Two noise inputs to the detector are found to be significant: optical attenuation noise and marker shot noise. Measurements were made in the self-preserving region of a smoke-marked turbulent jet exhausting into a secondary air stream. Radial distributions of mean particle concentration, concentration intensity, and intermittency were measured at several streamwise locations. Concentration fluctuation power spectra, and the micro and integral scales of the concentration fluctuations were measured on the jet centerline. Separate pitot and static tubes were used to measure the mean velocity. The results were compared with measurements of the temperature and smoke concentration fields in free jets. Dissert. Abstr.

N75-33342* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FILTER REGENERATION SYSTEMS Patent
Victor A. DesCamp (Martin Marietta Corp., Denver), Michael W. Boex (Martin Marietta Corp., Denver), Michael W. Hussey (Martin Marietta Corp., Denver), and Thomas P. Larson, inventors (to NASA) (Martin Marietta Corp., Denver) Issued 23 Sep. 1975 21 p Filed 3 Aug. 1973 Supersedes N73-28179 (11 - 19, p 2255) Sponsored by NASA
(NASA-Case-MSC-14273-1; US-Patent-3,907,686; US-Patent-Appl-SN-385522; US-Patent-Class-210-259; US-Patent-Class-210-82; US-Patent-Class-210-234; US-Patent-Class-210-304; US-Patent-Class-210-333; US-Patent-Class-210-340; US-Patent-Class-210-411; US-Patent-Class-210-425; US-Patent-Class-210-512) Avail: US Patent Office CSCL 20D

A system is described for regenerating a system filter in a fluid flow line where the filter normally retains particulate matter entrained in the fluid flow in one direction. The system involves a filter structure in which reverse or back flow through the filter will dislodge particulate matter from a filter element in the filter. Entrained particulate in the fluid back flow is passed to a vortex separator which separates by centrifugal forces and densities, the particulate from the fluid. The cleansed fluid is passed through a separate filter and can be returned to the system. The system for using the separator and separate filter in conjuction with the system filter can take the various forms including: embodiments where an independent pump is employed and the system filter is releasably coupled with separator, the separate filter, and the pump in a closed loop, and embodiments where the fluid from the system is diverted by valves to reverse through the system filter and output to the system from the separate filter.
Official Gazette of the U.S. Patent Office

N75-33343+ Engineering Sciences Data Unit, London (England).
FLUID FORCES ON LATTICE STRUCTURES
Aug. 1975 46 p refs Sponsored by The Royal Aeron. Soc., Inst. of Chem. Engr., and Inst. of Structural Engr.
(ESDU-75011) Copyright. Avail: NTIS HC $386.50

Data are presented for estimating the mean fluid forces acting on lattice frameworks which are normally constructed from flat-sided members, round sections, or a combination of these shapes. The data presented are applicable to other types of

lattice structures such as the lattice girders of bridges, cranes, and pylons. Data for the following cases are included: isolated structural members such as girders and cylinders, single frameworks, frameworks in tandem, and rectangular- and triangular-section tower frameworks. The two categories of members, namely flat-sided and circular-section, are considered for each case. A summary chart of the data is given. Author

N75-33344*# Wyle Labs., Inc., Huntsville, Ala.
ANALYSIS OF SCREECHING IN A COLD FLOW JET EXPERIMENT
M. E. Wang, R. M. Slone, Jr., J. E. Robertson, and L. Keefe Jun. 1975 72 p refs
(Contract NAS8-30747)
(NASA-CR-143943; WR-75-2) Avail: NTIS HC $4.25 CSCL 20D

The screech phenomenon observed in a one-sixtieth scale model space shuttle test of the solid rocket booster exhaust flow noise has been investigated. A critical review is given of the cold flow test data representative of Space Shuttle launch configurations to define those parameters which contribute to screech generation. An acoustic feedback mechanism is found to be responsible for the generation of screech. A simple equation which permits prediction of screech frequency in terms of basic testing parameters such as the jet exhaust Mach number and the separating distance from nozzle exit to the surface of model launch pad is presented and is found in good agreement with the test data. Finally, techniques are recommended to eliminate or reduce the screech. Author

N75-33345*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A CUBIC SPLINE APPROXIMATION FOR PROBLEMS IN FLUID MECHANICS
Stanley G. Rubin (Polytechnic Inst. of New York, Farmingdale) and Randolph A. Graves, Jr. Washington Oct. 1975 93 p refs
(NASA-TR-R-436; L-9929) Avail: NTIS HC $4.75 CSCL 20D

A cubic spline approximation is presented which is suited for many fluid-mechanics problems. This procedure provides a high degree of accuracy, even with a nonuniform mesh, and leads to an accurate treatment of derivative boundary conditions. The truncation errors and stability limitations of several implicit and explicit integration schemes are presented. For two-dimensional flows, a spline-alternating-direction-implicit method is evaluated. The spline procedure is assessed, and results are presented for the one-dimensional nonlinear Burgers' equation, as well as the two-dimensional diffusion equation and the vorticity-stream function system describing the viscous flow in a driven cavity. Comparisons are made with analytic solutions for the first two problems and with finite-difference calculations for the cavity flow. Author

N75-33346*# Washington Univ., Seattle.
REDUCTION OF WIND TUNNEL WALL INTERFERENCE BY CONTROLLED WALL FLOW
Samuel Bernstein, (Flow Res., Inc., Kent, Wash.) and Robert G. Joppa [1975] 58 p refs
(Grant NGL-48-002-010)
(NASA-CR-119090) Avail: NTIS HC $4.25 CSCL 20D

An alternate method of testing was developed in which flow through the porous walls of the tunnel was actively controlled so as to approximate free air conditions in the neighborhood of the model during the test. The amount and distribution of the controlled flow through the walls is computed using a potential flow representation of the model based on the measured lift. Theoretical analysis is presented to prove the convergence of the method to free air conditions and to substantiate the general three-dimensional theory of operation when the normal flow distribution is continuous. A two-dimensional tunnel was constructed to evaluate the concept. Results show that substantial reduction of wall interference may be achieved with relatively low values of porosity of actively controlled walls. Author

N75-33347*# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
MEASUREMENT OF DENSITY AND TEMPERATURE IN A HYPERSONIC TURBULENT BOUNDARY LAYER USING THE ELECTRON BEAM FLUORESCENCE TECHNIQUE Ph.D. Thesis. Final Report, 1 Oct. 1969 - 1 Sep. 1972
Angus D. McRonald Jul. 1975 142 p refs
(Grant NGR-05-018-140)
(NASA-CR-119169; USC-53-4514-8152) Avail: NTIS HC $5.75 CSCL 20D

Mean density and temperature fluctuations were measured across the turbulent, cooled-wall boundary layer in a continuous hypersonic (Mach 9.4) wind tunnel in air, using the nitrogen fluorescence excited by a 50 kV electron beam. Data were taken at three values of the tunnel stagnation pressure, the corresponding free stream densities being equivalent to 1.2, 4.0, and 7.4 torr at room temperature, and the boundary layer thicknesses about 4.0, 4.5, and 6.0 inches. The mean temperature and density profiles were similar to those previously determined in the same facility by conventional probes (static and pitot pressure, total temperature). A static pressure variation of about 50% across the boundary layer was found, the shape of the variation changing somewhat for the three stagnation pressure levels. The quadrupole model for rotational temperature spectra gave closer agreement with the free stream isentropic level (approximately 44 K) than the dipole model. Author

N75-33348*# Kanner (Leo) Associates, Redwood City, Calif.
BUBBLES IN LIQUID: EUROMECH 7
C. Reuterswaerd Washington NASA Oct. 1975 21 p refs Transl. into ENGLISH from Swedish report FOA-P-C-1281-40, Res. Inst. of Natl. Defense (Stockholm), Aug. 1968 17 p
(Contract NASw-2790)
(NASA-TT-F-16614; FOA-P-C-1281-40) Avail: NTIS HC $3.25 CSCL 20D

A convention was held in Grenoble during April 23 to 26, 1968 to discuss the mechanics of liquids containing bubbles. Summaries are given of selected presentations and discussions which have special relevance to problems dealing with adiabatic flow in foam. Author

N75-33349*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
NUMERICAL CALCULATIONS OF THE SUPERSONIC FLOW OF A VISCOUS FLUID ON A PARABOLIC OBSTACLE
Roger Peyret and Henri Viviand Washington NASA Sep. 1975 22 p refs Transl. into ENGLISH from Rech. Aerosp. (France), no. 3, May-Jun. 1972 p 123-131
(Contract NASw-2789)
(NASA-TT-F-16559) Avail: NTIS HC $3.25 CSCL 20D

The two-dimensional supersonic flow on a parabolic, semi-infinite obstacle was calculated, at moderate Reynolds numbers, by numerical solution of the unsteady Navier-Stokes equations. The steady-state solution is obtained as the limit, for infinite time, of the unsteady-state solution. A numerical semi-implicit scheme is used, with one step in time and leads to a stability criterion less restrictive than the conventional explicit model. This model is, in fact, consistent with the Navier-Stokes equations only in the steady-state. The problem of the treatment of wall conditions, in particular that of calculating the density, is solved by a simple method free of any convergence difficulty. Numerical results are given for an upstream Mach number of 2, and for values of the Reynolds number up to 200. Author

N75-33350*# Kanner (Leo) Associates, Redwood City, Calif.
HEAT TRANSFER THROUGH PHASE CHANGE AND CENTRIFUGATION APPLICATION TO TURBINE BLADE COOLING
J. Genot and E. LeGrives Washington NASA Oct. 1975 20 p refs Transl. into ENGLISH of conf. paper from Assembly for Intern. Heat Transfer Conf. Presented at 4th Intern. Heat Transfer Conf., v. 1, 1970 p HE2.2.1-HE2.2.12
(Contract NASw-2790)
(NASA-TT-F-16624) Avail: NTIS HC $3.25 CSCL 20D

Theoretical analysis is presented of heat transfer conditions obtainable through phase change in a metallic heat carrier exposed to such strong centrifugation as that encountered in the case of turbine blades. The main concerns of the study are the kinetics of condensed droplets and the closed-cycle heat transfer performance through peripheral evaporation and condensation at the externally cooled hub. The operating principle underlying the proposed heat transfer technique was verified by means of an ethyl alcohol and cesium containing pressure vessel centrifugated

at the end of a revolving arm; the requirements were examined for a high-temperature experiment at high acceleration values.
Author

N75-33351# ARO, Inc., Arnold Air Force Station, Tenn.
RELAXATION SOLUTION OF HIGH SUBSONIC CASCADE FLOWS
F. L. Shope and B. Lakshminarayana (Penn. State Univ., University Park) 2 Sep. 1975 29 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Aircraft in Dec. 1975 Sponsored by AF
Avail: NTIS HC $3.75

The relaxation technique was used to predict high subsonic flows through a cascade of airfoils. The problem is formulated in terms of two differential equations involving the stream function and density as functions of the cartesian coordinates. One equation results from irrotationality and the other from conservation of energy. The flow is assumed to be steady, two-dimensional, and isentropic. Besides periodicity and wall tangency, boundary conditions include enforcement of the Kutta condition, or alternately, an outlet angle, and the requirement of uniformity at infinity using a linear regression technique. The usual difficulties are encountered with the central finite difference operator in the transonic regime, but complete solutions were obtained for high-subsonic, subcritical flows, and agreement with experimental data is reasonably good.
Author

N75-33352*# LTV Aerospace Corp., Dallas, Tex.
SINDA/SINFLO COMPUTER ROUTINE, VOLUME 1, REVISION A
J. A. Oren and D. R. Williams 15 Feb. 1975 160 p refs Prepared in cooperation with TRW Systems Group, Houston, Tex.
(Contract NAS9-10435)
(NASA-CR-144511; Rept-2-53002/4R-3167-Vol-1) Avail: NTIS HC $6.25 CSCL 20D

The SINFLO package was developed to modify the SINDA preprocessor to accept and store the input data for fluid flow systems analysis and adding the FLOSOL user subroutine to perform the flow solution. This reduced and simplified the user input required for analysis of flow problems. A temperature calculation method, the flow-hybrid method which was developed in previous VSD thermal simulator routines, was incorporated for calculating fluid temperatures. The calculation method accuracy was improved by using fluid enthalpy rather than specific heat for the convective term of the fluid temperature equation. Subroutines and data input requirements are described along with user subroutines, flow data storage, and usage of the plot program.
Author

N75-33353*# LTV Aerospace Corp., Dallas, Tex.
SINDA/SINFLO COMPUTER ROUTINE, VOLUME 2, REVISION A
J. A. Oren and D. R. Williams 15 Feb. 1975 268 p Prepared in cooperation with TRW Systems Group, Houston, Tex.
(Contract NAS9-10435)
(NASA-CR-144512; Rept-2-53002/4R-3167-Vol-2) Avail: NTIS HC $8.50 CSCL 20D

Listings of subroutines which were added and modified during the development of SINDA/SINFLO are presented in alphabetical order. For Volume 1, see N75-33352.
M.J.S.

N75-33354# Cincinnati Univ., Ohio.
TWO PHASE PRESSURE DROP ACROSS ABRUPT AREA CHANGES
A. Husain and J. Weismann Jan. 1975 124 p refs
(Contract AT(11-1)-2152)
(COO-2152-15) Avail: NTIS HC $9.25

The research was undertaken to develop a coherent view of two-phase pressure drop across abrupt area changes during steady flow. The objectives of the program were to establish an additional data base of observations of two-phase pressure drop across abrupt area changes, and to determine whether a single model based one-dimensional momentum theory can correlate the data obtained in the present investigation as well as that in the literature. Examination of the data available in the literature indicated that most of the pressure drop measurements across abrupt area changes were made with the steamwater system. To assure the generality of the correlating approaches developed, it was decided to conduct the test program with a nonwater system. The freon-freon vapor system was selected for this purpose.
NSA

N75-33355# Institut Franco-Allemand de Recherches, St. Louis (France).
LASER VELOCIMETRY IN TURBULENT FLOW [VELOCIMETRIE LASER DANS DES ECOULEMENTS TURBULENTS]
X. Bouis, J. Haertig, J. P. Hancy, and G. Koerber 30 Jan. 1975 52 p refs In FRENCH
(Contract DRME-74/272)
(ISL-1/75) Avail: NTIS HC $4.25

A laser anemometer for turbulent flow analysis is described. Particles pass through two superimposed interference fringes of different orientation produced by an argon laser and detected by photomultiplier tubes with interferential filters; two instantaneous velocity components are obtained independently of other mechanical and thermomechanical parameters. In turbulent zones where velocity may invert itself, a Bragg cell can be introduced. Application to computation of the autocorrelation function and spectral power density of the velocity fluctuations are outlined. Special care was taken to ensure that particles actually follow the flow, that the measurement is sufficiently small, and that sampling bias was eliminated.
ESA

N75-33356# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
INTERMITTENCY, THE ENTRAINMENT PROBLEM Technical Interim Report, Jun. 1971 - Jun. 1973
P. M. Bevilaqua Mar. 1975 105 p refs
(AF Proj. 7116)
(AD-A011584; ARL-75-0095) Avail: NTIS CSCL 20/4

The mechanism of entrainment in turbulent wake flows has been analytically and experimentally examined. It is argued that the development of the wake is dominated by the vortices shed from the recirculation region. These vortices cause the rapid diffusion of the mean flow and are responsible for the appearance of waves on the turbulent interface. An explanation for the persistence of the vortices is found in terms of a strain energy stored in the anisotropy of the vortices on the mean flow is described by relating the size and strength of the vortices to an additional eddy viscosity.
GRA

N75-33357# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USE OF A PRINCIPLE OF MINIMUM VALUES OF DERIVATIVE TO THE CONSTRUCTION OF FINITE DIFFERENCE DIAGRAMS FOR THE CALCULATION OF THE DISCONTINUOUS SOLUTION OF GAS DYNAMICS
V. P. Kolgan 8 Jan. 1975 35 p refs Transl. into ENGLISH from Tsentr. Aerogidrodinamicheskii Inst. Uch. Zap. (USSR), v. 3, no. 6, 1972 p 68-77
(AD-A007198; FTD-MT-24-0518-75) Avail: NTIS CSCL 20/4

Difference diagrams were constructed for the model equation which possess the second order of accuracy in coordinates and the first order of accuracy in time. The properties of the diagrams were studied, and the results of the study were used for constructing a diagram for solving one-dimensional unsteady equations of gas dynamics.
M.J.S.

N75-33358# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.
A NUMERICAL MODEL FOR THE PREDICTION OF TWO DIMENSIONAL UNSTEADY FLOWS OF MULTICOMPONENT GASES WITH STRONG BUOYANCY EFFECTS AND RECIRCULATION
Michael L. Doria 12 Nov. 1974 50 p refs
(Grant NSA ATA73-07749-A01)
(PB-242240/0; TR-37191-74-4; NSF/RA/E-74-064) Avail: NTIS HC $3.75 CSCL 13L

A model which makes use of the full elliptic equations for mass, species, momentum and energy balance is presented. The full equation of state for a mixture of perfect gases is incorporated. Thus density dependence on species concentration and temperature is allowed for. The model also allows for nonuniform transport properties, turbulence, and complex boundary conditions. The model is a valuable tool in the prediction of such effects as the

motion of hot gases generated by a fire in a room or corridor; the ventilation of the fire through windows and doorways; the convective and radiative heat fluxes to the ceiling, floor, and side walls; and the rate of fuel consumption. GRA

N75-33359# National Bureau of Standards, Washington, D.C. Thermal Engineering Section.
METHOD OF TESTING FOR RATING THERMAL STORAGE DEVICES BASED ON THERMAL PERFORMANCE Interim Report
George E. Kelly and James E. Hill May 1975 46 p refs
(COM-75-10685/6; NBSIR-74-634) Avail: NTIS HC $3.75 CSCL 13A

A study was made of the different techniques that could be used for testing thermal storage devices and rating them on the basis of thermal performance. This document outlines a proposed standard test procedure based on that study. It is written in the format of a standard of the American Society of Heating, Refrigerating, and Air Conditioning Engineers and specifies the recommended apparatus, instrumentation, and test procedure. GRA

N75-33360# Naval Surface Weapons Center, White Oak, Md.
AN INTEGRAL APPROACH TO TRANSIENT HEAT-CONDUCTION PROBLEMS WITH PHASE TRANSITION
Tse-Fou Zien 12 Mar. 1975 44 p refs
(ZR0000101)
(AD-A010793; NSWC/WOL/TR-75-37) Avail: NTIS CSCL 20/4

An approximate method for studying transient heat-conduction problems is presented. Its application to various linear problems and nonlinear problems involving phase transitions is described by means of several idealized problems. The method is basically a refined version of the well-known Karman-Pohlhausen integral technique in boundary-layer theory, and represents a further development of the basic ideas previously exploited to calculate skin friction and heat transfer in boundary-layer flows. The approximate solutions obtained are extensively compared with existing exact solutions and those of the classical Karman-Pohlhausen method. From the simplicity and accuracy of the present method as demonstrated in the results, the potential utility of the method in providing simple, engineering solutions to complex aerodynamic heating problems can be inferred. GRA

N75-33361# Iowa Inst. of Hydraulic Research, Iowa City.
EXTERNAL ROUGHNESS EFFECTS ON THE MEAN WIND PRESSURE DISTRIBUTION ON HYPERBOLIC COOLING TOWERS
Cesar Farell and Federico E. Maisch Aug. 1974 60 p refs Sponsored in part by the Marley Co., Mission, Kans.
(Grant NSF GK-35795)
(PB-242406/7; IIHR-164) Avail: NTIS HC $4.25 CSCL 20D

The effect of external, concentrated roughness elements or ribs on the mean pressure distributions on model hyperbolic cooling towers in uniform wind was experimentally investigated in the 5-foot low-turbulence wind tunnel of the Iowa Institute of Hydraulic Research. Several longitudinal rib configurations were tested, varying systematically rib height, rib width, and rib spacing. Three uniformly distributed, or random, roughnesses were also tested for purposes of comparison. GRA

N75-33362# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
DOUBLE-DIFFUSIVE CONVECTIVE INSTABILITY IN A HORIZONTAL FLUID LAYER
Richard I. Loehrke and John H. Wright Feb. 1975 30 p refs
(Contract N00014-67-A-0299-0009; NR Proj. 083-250)
(AD-A011079; TR-4) Avail: NTIS CSCL 20/4

The convective stability of a horizontal layer of water with salt and heat addition from below was studied experimentally. The layer was bounded above and below by porous metal plates through which both heat and salt could diffuse. A well-mixed region of warm, salty water below the lower plate and another of cooler, fresher water above the upper plate set the temperature and concentration differences for the intervening quiescent layer. With a fixed, constant concentration gradient established between the plates the temperature difference was slowly increased until convective motions were observed. The stability boundary for this system lies within the unstable region predicted by linear theory for a horizontal layer with constant gradients and stress-free boundaries and approaches the linear boundary at high Rayleigh numbers. GRA

N75-33363# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
HEAT AND MASS TRANSFER IN LAYERED NATURAL CONVECTION
Thomas R. Mancini, Richard I. Loehrke, and Robert D. Haberstroh Mar. 1975 29 p refs
(Contract N00014-67-A-0299-0009; NR Proj. 083-250)
(AD-A011080; TR-5) Avail: NTIS CSCL 20/4

In a double-diffusive system (for example, heat and salt diffusing upward through water) a layered structure may form. This structure consists of horizontal convecting layers separated by non-convecting interfaces. The transport of heat and salt through a two-layer system can be calculated on the basis of a simple, mechanistic model described in this paper. The model predicts behavior which is consistent with results of a series of thermohaline convection experiments. The extension of these results to systems with greater numbers of layers is discussed. GRA

N75-33364# Naval Postgraduate School, Monterey, Calif.
AN EXACT SOLUTION TO THE TRANSONIC EQUATION
Oscar Biblarz Apr. 1975 28 p refs
(AD-A011086; NPS-57Z175041) Avail: NTIS CSCL 20/4

The small disturbance equation of transonic flow is solved by a separation of variables technique. The resulting ordinary, nonlinear differential equations are studied in the phase plane where the general solution represents the behavior of the perturbation velocities. In the phase plane, the character of transonic flow is evident. An asymptotic explicit solution is given which encompasses the sonic flow solution. Numerical integration results for the implicit equations are presented and two flows are examined which are intrinsic to the form of the solution. GRA

N75-33365# Pennsylvania State Univ., University Park. Applied Research Lab.
TIME SCALE AND MOLECULAR WEIGHT DISTRIBUTION CONTRIBUTIONS TO DILUTE POLYMER SOLUTION FLUID MECHANICS
Neil S. Berman and William K. George 19 Feb. 1974 22 p refs Presented at the Twenty-Fourth Heat Transfer and Fluid Mech. Inst., 12-14 June 1974 Submitted for publication
(Contract N00017-73-C-1418)
(AD-A011091; TM-74-34) Avail: NTIS CSCL 20/4

Experimental results on drag reduction in pipe flow, pitot tube errors and polymer degradation are presented to support a thickened sublayer model for dilute polymer solutions. The proposed model exhibits onset when the flow time scale equals the polymer time scale and increased drag reduction, degradation or pitot tube error as increased fractions of the polymers in the distribution are stretched by the flow. Eventually a limit is reached when the measure of increased sublayer thickness or increased effective viscosity in a pipe flow core reaches a limit due to entanglement of stretched molecules. The model correlates well with the experimental data. GRA

N75-33366# Duvvuri Research Associates, Chula Vista, Calif.
ANALYSIS OF COANDA REATTACHMENT ON CURVED SURFACES Interim Technical Report, 21 May - 21 Dec. 1973
Tirumalesa Duvvuri and Joel T. Park Apr. 1975 52 p refs
(Contract F33615-73-C-4120; AF Proj. 7116)
(AD-A010620; DRA-TR-73-01; ARL-75-0101; ITR-1) Avail: NTIS CSCL 20/4

Current developments in powered-lift STOL aircraft has renewed interest in jet reattachment to adjacent surfaces, the phenomenon also known as the Coanda effect. The experiments and theories on this subject over the past decade have been reviewed. Since reattachment distance on a curved surface has been neither measured nor predicted, an analysis was developed for the prediction of reattachment distance with offset, radius, and ventilation flowrate as parameters. A pair of non-linear equations have been solved on a computer with a minimization

technique. Attachment distance as measured along the curved surface increases with offset, ventilation flowrate, and surface radius. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N75-33367* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METEOROID IMPACT POSITION LOCATOR AID FOR MANNED SPACE STATION Patent
John D. DiBattista, inventor (to NASA) Issued 29 Jul. 1975 10 p Filed 2 Oct. 1973 Supersedes N73-32348 (11 - 23, p 2793)
(NASA-Case-LAR-10629-1; US-Patent-3,896,758; US-Patent-Appl-SN-402867; US-Patent-Class-116-114AH; US-Patent-Class-73-12; US-Patent-Class-73-170R; US-Patent-Class-73-432PS) Avail: US Patent Office CSCL 14B

Meteoroid impacts in space vehicles are located by coating the metallic interior wall of the space vehicle with a thin layer of a coating material having contrasting color to that of the vehicle interior wall. The coating is capable of flaking or chipping off when an impacting meteoroid deforms said wall. Official Gazette of the U.S. Patent Office

N75-33368* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASUREMENT OF GAS PRODUCTION OF MICROORGANISMS Patent
Judd R. Wilkins, Albin O. Pearson, and Stacey M. Mills, inventors (to NASA) Issued 23 Sep. 1975 20 p Filed 24 Jul. 1974 Supersedes N74-32518 (12 - 22, p 2647)
(NASA-Case-LAR-11326-1; US-Patent-3,907,646; US-Patent-Appl-SN-491416; US-Patent-Class-195-103.5R) Avail: US Patent Office CSCL 14B

A simple apparatus and method is disclosed for measuring gas production by microorganisms using a pressure transducer to sense pressure buildup by members of the Enterobacteriaceae group of bacteria. The test system consists of a 5.0 psid pressure transducer and a pressure equalizer valve attached to the metal cap of a 20 x 150 mm test tube. Gas pressure is recorded on a strip-chart recorder. Official Gazette of the U.S. Patent Office

N75-33369* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SELF-SUPPORTING STRAIN TRANSDUCER Patent
Ira S. Hoffman, inventor (to NASA) Issued 23 Sep. 1975 11 p Filed 23 May 1974 Supersedes N74-25931 (12 - 15, p 1790)
(NASA-Case-LAR-11263-1; US-Patent-3,906,788; US-Patent-Appl-SN-472775; US-Patent-Class-73-141A) Avail: US Patent Office CSCL 14B

A strain transducer is described for use in the measurement of static or quasi-static high strain levels at stress concentration points in holes in flat plates. Cantilever springs constructed by machining the material to appropriate flexibility, permit self-alinement, and constant contact with the test specimen. Used in conjunction with a strain gage or other transducer, it enables testing far beyond the strain gage's normal limits for high strains and number of load cycles. Official Gazette of the U.S. Patent Office

N75-33370*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MAGNETOMETER Patent Application
W. J. Debnam, Jr., C. L. Fales, R. A. Breckenridge, and A. V. Pohm, inventors (to NASA) (Iowa State Univ. of Sci. and Technol.) Filed 4 Feb. 1975 15 p
(NASA-Case-LAR-11617-1; US-Patent-Appl-SN-547072) Avail: NTIS HC $3.25 CSCL 14B

A magnetometer with a miniature transducer is described which can be scanned automatically. The magnetometer includes a transducer that has an active region of approximately 0.64 mm x 0.76 mm and is capable of good spatial resolution of magnetic fields as low as 0.02 oe. The magnetometer employs an automatic transducer scanning technique; it has a transducer which is rugged and flat and can measure magnetic fields as close as 0.08 mm from any relatively flat surface. The magnetometer was used to provide an external means of determining the presence of magnetic remanence in the magnetic word strap keepers on memory planes of experimental and production line plated-wire memories, and to provide measurements of the transverse magnetic field components at the surface of geological rock specimens. NASA

N75-33371*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
LARGE SPACE TELESCOPE CONTROL MOMENT GYRO TEST PROGRAM Final Report
Eugene Salamin and George J. Bukow Jul. 1975 68 p refs (Contract NAS8-30249)
(NASA-CR-143973; R-896) Avail: NTIS HC $4.25 CSCL 03A

The underlying theory and design of test instrumentation and computer techniques used to determine the power spectral density (PSD) of the third generation gyro are described in detail. Acceptance test results on the completed instrument are presented as well as composite PSD plots. The measured RMS noise over the frequency band 0.0025 - 10 Hz was 0.012 arc seconds. Results obtained at Martin Company indicate an RMS noise of 0.009 arc seconds (0.05 - 10 Hz). The results obtained showed the TGG performance was close to the proposed LST requirements but that additional development work would be needed to reduce the TGG noise to within more desirable limits. Author

N75-33372# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
NON-CONTACTING CAPACITIVE WAVE TRANSDUCERS, PART 2: DESIGN AND DEVELOPMENT OF CAPACITIVE WAVE TRANSDUCER
C. M. G. Zwarts May 1975 51 p
(NRC-14824-Pt-2; MI-837; ISSN-0077-555x) Avail: NTIS HC $4.25 CSCL 14B

A device which uses an electrode to sense the vertical distance to the water surface was developed to measure wave profile and amplitude in hydraulic models and flumes. The factors determining accuracy are analyzed; circuits and practical design features are given. Author

N75-33373*# Scientific Translation Service, Santa Barbara, Calif.
QUARTZ ACCELEROMETER WITH A CAPACITANCE-TYPE MOTION SENSOR
V. I. Osika, G. A. Perepelkin, Ye. I. Popov, V. V. Safronov, and A. I. Fedosov Washington NASA Oct. 1975 26 p refs Transl. into ENGLISH from Russian Report Pr-221 (Moscow), 1975 p 1-25
(Contract NASw-2791)
(NASA-TT-F-16605; PR-221) Avail: NTIS HC $3.75 CSCL 14B

Problems were examined which are related to the development and tests of a highly sensitive accelerometer for measuring gravitational inertial accelerations on an orbital earth station. Results are given of laboratory tests and the drift of an accelerometer having the sensitivity of 2 times 10 to the minus 7th power g is estimated. Author

N75-33374*# AiResearch Mfg. Co., Phoenix, Ariz.
PROGRAM TO DESIGN, FABRICATE, TEST, AND DELIVER A THERMAL CONTROL-MIXING CONTROL DEVICE, PHASE 1 Progress Report, 19 Feb. - 20 Aug. 1975
T. S. Thurston and S. W. Haley 16 Sep. 1975 26 p
(Contract NAS8-31289)
(NASA-CR-143987; AiResearch-75-410939(6); PR-6) Avail: NTIS HC $3.75 CSCL 14B

The development of a sensor capable of detecting temperature changes as a function of viscosity changes, was completed. This

type of sensor, consisting of an orifice bridge circuit, resulted in a device with a threshold above internally generated noise of 0.8C (1.5F). Data were obtained using a noise free Freon source provided by an air pressurized bladder. Tests conducted to operate the sensor from a typical Freon centrifugal pump system employing an air bubble accumulator for noise attentuation disclosed the sensor could be used only to sense temperature changes greater than 3.3C (6F) because of the excessively noisy output. This is attributed to the high frequency-pressure fluctuations in the Freon supply to the sensor. Author

N75-33375*# Beckman Instruments, Inc., Anaheim, Calif. Advanced Technology Operations.
CARBON DIOXIDE SENSOR Final Report
Sep. 1975 177 p
(Contract NAS9-14294)
(NASA-CR-144508; FR-2679-102) Avail: NTIS HC$7.00 CSCL 14B

Analytical techniques for measuring CO2 were evaluated and rated for use with the advanced extravehicular mobility unit. An infrared absorption concept using a dual-wavelength monochromator was selected for investigation. A breadboard carbon dioxide sensor (CDS) was assembled and tested. The CDS performance showed the capability of measuring CO2 over the range of 0 to 4.0 kPa (0 to 30 mmHg) P sub (CO2). The volume and weight of a flight configured CDS should be acceptable. It is recommended that development continue to complete the design of a flight prototype. Author

N75-33376*# National Aeronautics and Space Administration, Washington, D.C.
ANALYTICAL AND TEST EQUIPMENT: A COMPILATION Technology Utilization
May 1975 30 p
(NASA-SP-5972(03)) Avail: NTIS HC $1.00 CSCL 14B

A compilation is presented of innovations in testing and measuring technology for both the laboratory and industry. Topics discussed include spectrometers, radiometers, and descriptions of analytical and test equipment in several areas including thermodynamics, fluid flow, electronics, and materials testing. M.J.S.

N75-33377*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
SPECTRAL DENSITY MEASUREMENTS OF GYRO NOISE
Angelo Truncale, William Koenigsberg, and Ronald Harris Feb. 1972 94 p refs
(Contract NAS5-11002; DSR Proj. 55-29240)
(NASA-CR-144679; E-2641) Avail: NTIS HC $4.75 CSCL 14B

Power spectral density (PSD) was used to analyze the outputs of several gyros in the frequency range from 0.01 to 200 Hz. Data were accumulated on eight inertial quality instruments. The results are described in terms of input angle noise (arcsec 2/Hz) and are presented on log-log plots of PSD. These data show that the standard deviation of measurement noise was 0.01 arcsec or less for some gyros in the passband from 1 Hz down 10 0.01 Hz and probably down to 0.001 Hz for at least one gyro. For the passband between 1 and 100 Hz, uncertainties in the 0.01 and 0.05 arcsec region were observed. NASA

N75-33378# Cambridge Consultants Ltd. (England).
A SURVEY AND ASSESSMENT OF THE POSSIBILITIES TO DEFLECT OR SWEEP THE FIELD OF VIEW BY NON-MECHANICAL MEANS Final Report
M. J. Brookfield and Jaqueline Dawson Dec. 1974 179 p refs
(Contract ESTEC-2214/74-AK)
(CCL-P171; ESRO-CR(P)-650) Avail: NTIS HC $7.00

The field of nonmechanical optical image deflection is surveyed with particular emphasis on space applications. Moving mirrors involve a definite reliability hazard in the case of long life missions, and further disadvantage is the effect that moving parts have upon the attitude control of the spacecraft. Various analog and digital alternatives were investigated employing phenomena such as the electro-optic effect to achieve the required scan. It is concluded that there is no approach showing any promise of being able to replace directly the mechanical field of view scanning devices. A hybrid deflector is proposed, constituting a combination of a total internal reflection digital deflector and a piezoelectrically driven mirror deflector; such a combination is capable of high performance over a wide spectral range. ESA

N75-33379# Institut Franco-Allemand de Recherches, St. Louis (France).
ULTRAFAST SHUTTER FOR A CHRONO LENS WITH 24 SPARKS AFTER CRANZ-SCHARDIN [UN OBTURATEUR ULTRA-RAPIDE POUR UNE CHRONOLOUPE A 24 ETINCELLES D'APRES CRANZ-SCHARDIN]
H. F. Lehr and G. Weihrauch 17 May 1974 14 p refs In FRENCH Presented at the Assoc. Natl. de la Rech. Tech. 1st Colloq. on Material. et Appl. de la Cinematog. Rapide, Montrouge, France, 9-10 May 1974
(ISL-CO-7/74) Avail: NTIS HC $3.25

The ultrafast shutter for experiments consists of 6 chambers of glass enclosing a carbon black chamber and each such chamber covers 4 objectives. The carbon black is expulsed by the detonation of a cartridge. Experimental results show that a total obturation is attained in 25 microseconds. The presently developed model has a surface of 140 by 210 sq mm. ESRO

N75-33380# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
MEASURING THE RADON CONCENTRATION IN AIR [METING VAN DE RADONCONCENTRATIE IN LUCHT]
J. B. T. Aten, H. W. J. Bierhuizen, L. P. vanHoek, D. Ros, and J. Weber 1975 17 p In DUTCH Prepared jointly with Interuniversitair Reactor Inst.
(Contract A72/KLu/037)
(MBL-1975-12; IRI-190-75-01; TDCK-66104) Avail: NTIS HC $3.25

A simple transportable apparatus for measurement of the radar concentration in the air of a workshop was developed. An air sample is sucked through a filter and the decay curve of the alpha activity is measured. The counting speed 40 min after sampling gives an indication of the radon activity. The apparatus was calibrated by analyzing an analogous decay curve obtained with a big filter and a big air sample, the activity being measured with an anti-coincidence counter. ESA

N75-33381# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
HOLOGRAPHIC TECHNIQUE FOR MEASUREMENTS OF STRAIN
R. H. Berger, S. J. Marshall, R. H. Munis, and M. E. Fourney May 1975 14 p refs
(DA Proj. 4A1-61101-A-91)
(AD-A011247; CRREL-SR-227) Avail: NTIS CSCL 08/12

An experimental program was carried out to see if holographic interferometry could be used to determine Young's modulus and Poisson's ratio of ice using the ring test. Spurious rigid body deflections of up to 0.5 microinch were found when the sample was compressed. These motions are of such magnitude that they will affect the accuracy of the bore gauge measurements of ice strength. The technique most suited to measurements of the deformation of the ice ring is speckle interferometry. This technique is most sensitive to motions of the magnitude found when using the ring test on ice and it allows measurement of motion in each of the three orthogonal directions separately so that Young's modulus and Poisson's ratio may be obtained easily. GRA

N75-33382# Woods Hole Oceanographic Institution, Mass.
ASSEMBLY, OPERATION AND PERFORMANCE DETAILS OF A 10-INPUT ALPHA SPECTROMETRY SYSTEM
Don R. Mann, Hugh D. Livingston, and Allan G. Gordon Apr. 1975 21 p refs Sponsored by ERDA
(PB-241732/7; WHOI-75-26) Avail: NTIS HC $3.25 CSCL 18D

An account is given of the assembly, operation and performance of a 10-detector alpha spectrometer system which is being used for the low-level detection of low level environmental alpha-emitting radionuclides-especially those in the transuranic family. Precautions necessary to the maintenance of the low background characteristics of the surface barrier detectors are

described. Factors which affect system resolution are reviewed. GRA

N75-33383*# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
DEVELOPMENT OF A DYNAMIC PRESSURE CALIBRATION TECHNIQUE Progress Report, 15 Feb. - 15 Aug. 1974
Carol F. Vezzetti, John S. Hilten, and Paul S. Lederer 5 Jun. 1975 21 p refs
(NASA Order L-88319)
(NASA-CR-143624; COM-75-10817/5; NBSIR-75-708) Avail: NTIS HC $3.25 CSCL 14B

The report deals with work continuing on the development of a method of producing sinusoidally varying pressures of at least 34 kPa zero-to-peak with amplitude variations within plus or minus 5% up to 2 kHz for the dynamic calibration of pressure transducers. Sinusoidally varying pressures of 34 kPa zero-to-peak were produced between 40 Hz and 750 Hz by vibrating a 10-cm column of a dimethyl siloxane liquid at 36gn zero-to-peak. Damping of the liquid column was accomplished by packing the fixture tube with a number of smaller diameter tubes. GRA

N75-33384# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
DEVELOPMENT OF A NONPENETRATING INDUCTANCE PROBE FOR MEASURING LUBRICATING FILM THICKNESS IN A DYNAMIC SEAL Ph.D. Thesis
William Ross Duncan Dec. 1974 152 p refs
(Contract N00014-68-A-0144)
(AD-A010911; ME-74-T57-20) Avail: NTIS CSCL 14/2

A report is made on the development of a nonpenetrating inductance type proximity probe. The probe was designed to measure the film thickness between the faces of a dynamic seal. The inductance probe design equations, along with computer programs to solve them, are presented. The inductance probe was designed to measure the distance between the faces of a dynamic seal without penetrating the face of the seal. The programs that are presented may be modified slightly and applied to many different situations. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N75-33385 Polish Academy of Sciences, Warsaw.
PULSED CARBON DIOXIDE LASER WITH HIGH REPETITION FREQUENCY [IMPULSOWY LASER CO2 Z DUZA CZESTOSCIA REPETYCJI]
Adolf Baranowski, W. Byszewski, and R. Ciesielski 2 Dec. 1974 27 p refs In POLISH
Avail: Issuing Activity

The pulsed carbon dioxide laser with a high frequency of pulse repetition in average peak outputs was studied. The applicability was investigated of using this laser for investigating dynamically generated plasma as well as for magneto-optic investigations of semiconductor properties. Topics discussed include the construction-technological basis of the carbon dioxide laser, its construction, and its parameters. Transl. by M.J.S.

N75-33386*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WAVEGUIDE CO2 LASER GAIN: DEPENDENCE ON GAS KINETIC AND DISCHARGE PROPERTIES
Steven C. Cohen Sep. 1975 34 p refs Submitted for publication
(NASA-TM-X-70996; X-723-75-249) Avail: NTIS HC $3.75 CSCL 20E

Using a simple rate equation approach the gas kinetic and discharge properties of waveguide CO2 lasers were examined. The dependence was calculated of the population inversion and laser small signal gain on gas pressure, gas mixture, pumping rate (discharge current), tube bore diameter, and wall temperature. At higher pressures the gain is optimized by using more helium rich mixtures and smaller bore diameters. The dependence of laser tunability on the gas kinetic properties and cavity losses was determined, it was found that for loss cavities the laser tunability may substantially exceed the molecular fullwidth at half maximum. The more helium rich gas mixtures give greater tunability when cavity losses are small and less tunability when cavity losses are large. The role of the various gases in the waveguide CO2 laser is the same as that in conventional devices, by contrast with conventional lasers, the waveguide laser transition is homogeneously broadened. The dependence of gain on gas pressure and other kinetic and discharge properties differs substantially from that predicted by scaling results from conventional low pressure lasers. Author

N75-33387*# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
IMPROVED SEMI-CONDUCTOR LASER DEVICE, OPERATING, AT ROOM TEMPERATURE, WITH AN ARRAY OF THREE LASERS IN THE SPATIALLY COHERENT, FREE RUNNING MODE Final Report
E. M. Rutz 30 Jul. 1975 114 p refs
(Contract NAS8-30543)
(NASA-CR-143960) Avail: NTIS HC $5.25 CSCL 20E

The peak pulse power was increased by operating an array of three homostructure Ga As lasers in the laser device. A spatial filter in the laser device selects the spatially coherent, free running, mode. The optical peak power is 5 watts, which is three times the peak power of a single laser in the array. The far-field distribution of the three laser array is a single Gaussian beam of spatial coherence without sidelobes or grating lobes. The length of the optical pulses of spatial coherence was increased to 200 ns by improved heat transfer from the p-n junctions of the lasers to the metal housing of the pulse transformer, and by doubling the core area and increasing the turns of the primary windings of the pulse transformer. The mechanical stability of the laser device was improved and the transition from mechanical alignment to electro-mechanical alignment control, was facilitated. Author

N75-33388# Yale Univ., New Haven, Conn.
LASER PHOTOLYSIS STUDIES ON THE STRUCTURE AND PHOTOEXCITED STATES OF SOLVATED ELECTRONS Final Report, 1 Nov. 1973 - 31 Dec. 1974
G. A. Kenney-Wallace 1974 27 p refs
(Contract AT(11-1)-2410)
(COO-2410-1) Avail: NTIS HC $4.50

The assembly of a high powered, Q-switched Ruby laser-dye laser photolysis system was completed in order to make measurements of the solvation times and excited state lifetimes of solvated electrons in alcohols, employing laser saturation spectroscopy. Preliminary results are reported from laser saturation studies at 694 nm of solvated electrons in ethanol and 2-propanol. The solvated electrons were generated via the two photon ionization of selected arenes in alcohol at 347 nm. The results are interpreted in terms of a two-level saturable absorber and upper limits on the excited state lifetimes of solvated electrons are calculated. Solvation times of electrons in long chain alcohols, measured independently in picosecond pulse radiolysis, show that the time taken for the electron population to reach a fully relaxed, solvated ground state increased as the length of the alcohol chain increased with each solvated electron spectrum exhibiting a significant blue shift during the initial 10 to the minus 10s power. Author (NSA)

N75-33389# Los Alamos Scientific Lab., N.Mex.
LASER-PLASMA INTERACTIONS IN THE SCYLLA IC EXPERIMENT: PRELIMINARY ANALYSIS
T. M. York (Penna. State Univ., Univ. Park) and K. F. McKenna Apr. 1975 22 p refs
(Contract W-7405-eng-36)
(LA-5957-MS) Avail: NTIS HC $4.00

The interaction of high power laser beams with theta-pinch plasmas is examined. For the specific constraints of the CO2 laser and Scylla I-C, and with the theta-pinch fill pressure as a primary variable (100 mT-1000 mT), the physical problems of plasma heating, laser light backscatter, and channeling (converging diffraction of the laser beam) are considered. Prediction of the theta-pinch plasma parameters, prior to laser heating, is developed using snowplow theory. Author (NSA)

N75-33390# Institut Franco-Allemand de Recherches, St. Louis (France).
MODE COUPLING IN ORGANIC DYE LASERS [COUPLAGE DE MODES DANS LES LASERS A COLORANTS ORGANIQUES]
A. Hirth 25 Oct. 1973 28 p refs In FRENCH Conf. held at Bern, 25 Oct. 1973
(ISL-CO-3/73) Avail: NTIS HC $3.75

Saturable dye triggering is discussed together with relaxation time and pulse duration. The influence of stimulated emission is detailed. Experimental results of mode coupling with cyanines and xanthines, flash excited and not, are reported. ESA

N75-33391# United Aircraft Corp., East Hartford, Conn. Research Labs.
EFFECT OF A TURBULENT SHEAR FLOW ON A LASER BEAM Interim Report
E. A. Kush, S. N. Mapes, and H. T. Couch Mar. 1975 93 p refs
(Contract F44620-73-C-0031; AF Proj. 9781)
(AD-A010493; UARL-R75-912076-1; AFOSR-75-0615TR) Avail: NTIS CSCL 20/4

This is the second part of an overall program to investigate aerodynamic window flows and their effect on laser beam quality. The present effort has concentrated on the effects produced by interaction of the beam with the turbulent shear layers present in the aerowindow stream. These shear layers are the free mixing layers at the jet inner and outer boundaries and, in MECA (multi-element centrifugal aerowindow) configurations, the mixing layers between adjacent nozzle element flows. Evidence that the turbulence-induced degradation might be of significance evolved in the initial part of this study. The present investigation, therefore, is being applied to development of new analytical modeling approaches appropriate to shear layer turbulence, adaptation of existing atmosphere-oriented treatments where possible, and acquisition of experimental data which characterize laser degradation through small-scale, wind-tunnel type turbulence and to provide an understanding of the physical phenomena. GRA

N75-33392# Honeywell Corporate Research Center, Bloomington, Minn.
INVESTIGATION OF MATERIAL DAMAGE: INTERACTIONS OF TEA LASER RADIATION WITH SURFACES Interim Report, 15 Dec. 1973 - 14 Dec. 1974
John F. Ready Feb. 1975 86 p refs
(Contract F44620-73-C-0022; AF Proj. 9767)
(AD-A010485; AFOSR-75-0710TR) Avail: NTIS CSCL 20/5

This report describes three specific measurements involving interaction of a TEA CO2 laser beam with absorbing surfaces: (1) impulse transmitted to the target; (2) change of reflectivity of the target; (3) a mass spectrometric experiment to determine the energy spectrum of ions in the blowoff material. GRA

N75-33393# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
LOW LOSS WINDOW MATERIALS FOR CHEMICAL AND CO LASERS
James A. Harrington, Bernard Bendow, K. V. Namjoshi, S. S. Mitra, and D. L. Stierwalt 15 May 1975 26 p refs
(AF Proj. 5621)
(AD-A010462; AFCRL-TR-75-0275) Avail: NTIS CSCL 20/5

The optical absorption has been measured in a variety of materials (such as fluorides and titanates, which are candidates for service as low loss windows on DF-HF chemical or CO lasers. Measurements of the absorption coefficient beta at DF (3.8 micrometers) and HF (2.7 micrometers) frequencies were accomplished using CW chemical laser calorimetry. Beta as a function of frequency was obtained for the alkaline earth fluorides by measuring the spectral emittance at 100 C. A phenomenological model has been employed to calculate beta for these hosts as a function of frequency. Good agreement is obtained between theory and experiment. The calorimetric results indicate that the absorption in most materials studied is limited by extrinsic processes. At HF frequencies, hydroxyl ions in the bulk or on the surface are believed responsible for the high beta values. At both DF and HF frequencies surface absorption appears to be strong owing in part to absorption by organics which are often used in surface finishing. GRA

N75-33394# RAND Corp., Santa Monica, Calif.
A QUANTITATIVE THEORY OF NOBLE GAS ION LASER DISCHARGE: ARGON ION LASER
C. C. Chen Jan. 1975 91 p refs
(AD-A010963; P-5350) Avail: NTIS CSCL 20/5

Using the three temperature plasma formulation derived in an earlier paper, the authors have obtained numerical results for argon ion laser discharge parameter as functions of jR (the product of current density j and tube radius R) for selected values of pR (the product of the total filling pressure p and tube radius) at a fixed value of Tw (the tube wall temperature). The calculated electron temperature is found to be in good agreement with available experimental data. Calculations of the collisional excitation-rate-limited power output per unit length have been made for continuous wave (CW) argon ion lasers. It is found that the two-step excitation rate is quite adequate in explaining the experimentally observed argon ion laser output power per unit length. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N75-33395* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SYSTEM FOR ENHANCING TOOL-EXCHANGE CAPABILITIES OF A PORTABLE WRENCH Patent
Ray E. Marlow, inventor (to NASA) (Sperry Rand Corp., Huntsville, Ala.) Issued 23 Sep. 1975 25 p Filed 9 Aug. 1973 Supersedes N73-30462 (11 - 21, p 2553) Sponsored by NASA
(NASA-Case-MFS-22283-1; US-Patent-3,907,312; US-Patent-Appl-SN-387095; US-Patent-Class-279-89; US-Patent-Class-29-26A; US-Patent-Class-279-1B; US-Patent-Class-279-107; US-Patent-Class-294-86.33; US-Patent-Class-294-116) Avail: US Patent Office CSCL 13I

An improved system for enhancing the tool-exchange capabilities of a portable wrench is described. The system is characterized by a sleeve telescopically received by the housing of a wrench motor. A pressure-responsive catch supported by the sleeve is included for alternately grasping and releasing tools coaxially aligned with the wrench and seated within a tool receptacle. Official Gazette of the U.S. Patent Office

N75-33396*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
DESIGN AND APPLICATION OF SQUEEZE FILM DAMPERS FOR TURBOMACHINERY STABILIZATION
E. J. Gunter, L. E. Barrett, and P. E. Allaire Oct. 1975 67 p refs
(Grant NGR-47-005-050)
(NASA-CR-143631; ME-4040-122-75) Avail: NTIS HC $4.25 CSCL 21E

The steady-state transient response of the squeeze film damper bearing was investigated. Both the steady-state and transient equations for the hydrodynamic bearing forces are derived; the steady-state equations were used to determine the damper equivalent stiffness and damping coefficients. These coefficients are used to find the damper configuration which will provide the optimum support characteristics based on a stability analysis of the rotor-bearing system. The effects of end seals and cavitated fluid film are included. The transient analysis of rotor-bearing systems was conducted by coupling the damping and rotor equations and integrating forward in time. The effects of unbalance, cavitation, and retainer springs are included. Methods of determining the stability of a rotor-bearing system under the influence of aerodynamic forces and internal shaft friction are discussed. Author

N75-33397*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INTERACTIVE CUTTING PATH ANALYSIS PROGRAMS
John M. Weiner, Donald S. Williams, and Stephen R. Colley 1 Oct. 1975 17 p refs

(Contract NAS7-100)
(NASA-CR-119148; JPL-TM-33-738) Avail: NTIS HC $3.25 CSCL 13H

The operation of numerically controlled machine tools is interactively simulated. Four programs were developed to graphically display the cutting paths for a Monarch lathe, Cintimatic mill, Strippit sheet metal punch, and the wiring path for a Standard wire wrap machine. These programs are run on a IMLAC PDS-ID graphic display system under the DOS-3 disk operating system. The cutting path analysis programs accept input via both paper tape and disk file. Author

N75-33398# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS OF EASTERN EUROPE: SCIENTIFIC AFFAIRS NO. 481
20 Oct. 1975 27 p refs Transl. into ENGLISH from East European Articles
(JPRS-65968) Avail: NTIS HC $3.75

Articles are presented concerning the development of and progress in the various theoretical and applied scientific disciplines and technical fields, and the administration, structure, personnel, and research plans of leading East European scientific organizations and institutions, particularly the academies of sciences. Specific topics discussed include Black Sea shelf studies, water solvent polyelectrolytes, extraction of zeolite deposits, direct butt-seam welding, dosimeters, virus resistant pepper plants, and a computer for iron works. Author

N75-33399*# Kanner (Leo) Associates, Redwood City, Calif.
DIFFUSION WELDING OF VARIOUS COMBINATIONS OF MATERIALS WHICH ARE DIFFICULT TO WELD
Meta Velikonja Washington NASA Oct. 1975 20 p refs Transl. into ENGLISH from Varilna Tehn. (Yugoslavia), v. 23, no. 1, 1974 p 1-6
(Contract NASw-2790)
(NASA-TT-F-16629) Avail: NTIS HC $3.25 CSCL 13H

Basic parameters of surface preparation, temperatures, time, pressure and metallurgical factors are discussed. The process was accomplished by mechanical compression which causes the disappearance of the originally convergent surfaces due to growth of crystal grains, melting of surface impurities, or isolated diffusion of atoms on the originally convergent surface. Features of experiments in diffusion welding in a vacuum are discussed. Author

N75-33400*# Scientific Translation Service, Santa Barbara, Calif.
EXPLOSIVE-WELDED FIBER REINFORCED MATERIALS: STATUS OF TECHNIQUE AND POSSIBILITIES OF DEVELOPMENT
E. Wolff Washington NASA Oct. 1975 22 p refs Transl. into ENGLISH from Z. Wirt. Fertigung (Berlin), v. 69, no. 6, Jun. 1974 p 287-293
(Contract NASw-2791)
(NASA-TT-F-16628) Avail: NTIS HC $3.25 CSCL 13H

A wide variety of fibers (boron, V2A, tungsten, molybdenum, etc.) were successfully imbedded in a number of metal matrices (aluminum, nickel, zirconium, titanium) using an explosive welding technique. Semi-finished products can also be manufactured to provide shapes such as wing profiles and blades. Tensile strengths measured were as high as those above theoretically predicted. Mass production methods are also discussed. The materials are extremely heat resistant and it was proposed that 150 cm fiber reinforced turbine blades could be made which could withstand temperatures up to 1100 C. Author

N75-33401*# Martin Marietta Corp., Denver, Colo.
TRACK/TRAIN DYNAMICS TEST REPORT TRANSFER FUNCTION TEST. VOLUME 1: TEST
R. A. Vigil 30 May 1975 130 p refs
(Contract NAS8-29882)
(NASA-CR-143967; TR-005-TF-Vol-1) Avail: NTIS HC $5.75 CSCL 14B

A description is presented of the transfer function test performed on an open hopper freight car loaded with 80 tons of coal. Test data and a post-test update of the requirements document and test procedure are presented. Included are a statement of the test objective, a description of the test configurations, test facilities, test methods, data acquisition/reduction operations, and a chronological test summary. An index to the data for the three test configurations (X, Y, and Z-axis tests) is presented along with test sequence, run number, test reference, and input parameters. Author

N75-33402*# Martin Marietta Corp., Denver, Colo.
TRACK/TRAIN DYNAMICS TEST REPORT TRANSFER FUNCTION TEST. VOLUME 2: DATA BOOK, y-AXIS TESTS, ACTUATORS 180 DEG OUT OF PHASE. RUNS: 8, 9, 13, 14 AND 23
30 May 1975 269 p
(Contract NAS8-29882)
(NASA-CR-143968; TR-005-TF-Vol-2) Avail: NTIS HC $8.50 CSCL 14B

Graphical data are presented on the Y-axis transfer function tests. For Volume 1, see N75-33401. M.J.S.

N75-33403*# Martin Marietta Corp., Denver, Colo.
TRACK/TRAIN DYNAMICS TEST REPORT TRANSFER FUNCTION TEST. VOLUME 3: DATA BOOK, y-AXIS TESTS, ACTUATORS IN PHASE. RUNS: 15, 18, 19 AND 20
30 May 1975 212 p
(Contract NAS8-29882)
(NASA-CR-143969; TR-005-TF-Vol-3) Avail: NTIS HC $7.25 CSCL 14B

Graphical data are presented on the Y-axis transfer function tests. For Volume 1, see N75-33401. M.J.S.

N75-33404*# Martin Marietta Corp., Denver, Colo.
TRACK/TRAIN DYNAMICS TEST REPORT TRANSFER FUNCTION TEST. VOLUME 4: DATA BOOK, x-AXIS TESTS, ACTUATORS 180 DEG OUT OF PHASE. RUN 30. z-AXIS TESTS, SINGLE ACTUATOR. RUN 46
30 May 1975 128 p
(Contract NAS8-29822)
(NASA-CR-143970; TR-005-TF-Vol-4) Avail: NTIS HC $5.75 CSCL 14B

Graphical data are presented on the X-axis transfer function tests. For Volume 1, see N75-33401. M.J.S.

N75-33405# Oak Ridge Y-12 Plant, Tenn.
THERMOPHYSICAL PROPERTIES OF A TYPE 308 STAINLESS STEEL WELD
L. M. Greene, H. L. Richards, R. T. King, L. M. Greene, and D. M. Darby 30 Apr. 1975 51 p
(Contract W-7405-eng-26)
(Y-1967) Avail: NTIS HC $5.45

Thermal expansion, thermal diffusivity, specific heat, and thermal conductivity measurements were obtained in vacuo for a Type 304-308 stainless steel weldment for use in the liquid metal fast breeder reactor. Property measurements were somewhat variant, depending upon the direction of measurement, but the observed differences were small. Author (NSA)

N75-33406# Oak Ridge National Lab., Tenn.
MEASUREMENT OF FLAW SIZE IN A WELD SAMPLE BY ULTRASONIC FREQUENCY ANALYSIS
H. L. Whaley, Jr., L. Adler, K. V. Cook, and R. W. McClung May 1975 26 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4800) Avail: NTIS HC $4.50

An ultrasonic frequency analysis technique was developed and applied to the measurement of flaws in an 8-in.-thick heavysection steel specimen belonging to the Pressure Vessel Research Committee program. Using the technique the flaws occurring in the weld area were characterized in quantitative terms of both dimension and orientation. Several modifications of the technique were made during the study to include the application of several transducers and to consider ultrasonic mode conversion. Author (NSA)

N75-33407# Societe Europeenne de Propulsion, Bordeaux (France).
DEVELOPMENT AND QUALIFICATION OF AN ELECTRIC VALVE WITH DOUBLE METAL/METAL SEAT FOR SPACE-BORNE HYDRAZINE ENGINE CONTROL Final Report
R. Lecuyer and J. C. Rigal 10 Oct. 1974 89 p refs In FRENCH

(Contracts ESTEC-1072/70; ESTEC-1713/72-HP)
(SEP-TS/SE-42980/74; ESA-CR(P)-665) Avail: NTIS HC $4.75

Two electric double-action fuel valves of the same type were subjected to a qualification test program which included environmental and endurance tests. The working fluid used during these tests, except for the last part of the endurance tests, was isopropyl alcohol. Complementary endurance tests (800,000 activations in presence of hydrazine) was carried out on one of the valves. The valves were also tested in an acceleration (20 g) and thermal environment, measuring leakage during acceleration. The type of valve tested was found to have a constant electro-mechanical performance under these conditions and good leakproof characteristics. ESA

N75-33408# Range Commanders Council, White Sands Missile Range, N.Mex. Photographic Labs Working Group.
A CATALOG OF BEARINGS AND BUSHINGS FOR PHOTOGRAPHIC EQUIPMENT Final Report
1967 29 p
(AD-A010319) Avail: NTIS CSCL 13/9

The catalog was prepared to provide a ready reference to bearing types available for machine operation. It provides information on application and performance which can be used in selecting new and replacement bearings for motion picture processing equipment. GRA

N75-33409# Mitre Corp., McLean, Va.
ANALYSIS AND SIMULATION OF VEHICLE/GUIDEWAY INTERACTIONS WITH APPLICATION TO A TRACKED AIR CUSHION VEHICLE
R. J. Ravera and J. R. Anderes Feb. 1975 96 p refs
(Contract DOT-FR-30015)
(PB-242014/9; MTR-6839; FRA/ORD/D-75-38) Avail: NTIS HC $4.75 CSCL 13F

Several analytical methods for investigating the problem of vehicle/guideway dynamic interactions are presented. These methods include several digital programs, each tailored to solve a particular aspect of the vehicle/guideway problem. Also included are computerized frequency domain methods for rapid estimation of system sensitivity to principal parameters and for use in selecting candidate guideway parameters. The major tool is the full scale vehicle/guideway dynamic interaction simulation, TRAVSIM, which includes coupled vehicle/guideway dynamics, independently generated guideway roughness profiles, and data processing for obtaining vehicle output data in the various ride quality formats. GRA

N75-33410# Transportation Systems Center, Cambridge, Mass.
STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT. SAFETY IMPLICATIONS PANEL REPORT NO. 2 Special Congressional Report, Jun. - Oct. 1974
Harold G. Miller 10 Jan. 1975 45 p refs Sponsored in part by Committee on Commerce (U.S. Senate), Committee on Interstate and Foreign Commerce (U.S. House), and EPA, Washington, D.C.
(PB-241772/3; DOT-TSC-OST-75-11) Avail: NTIS HC $3.75; also available in a set of 8 reports as PB-241769-SET HC $29.00 CSCL 21D

This report contains four individual analyses related to the safety impact of increased small car usage and automobile weight reductions to improve fuel economy: (1) fuel economy as a function of weight, performance, and driving schedule; (2) traffic control for safety and fuel economy; (3) weight versus safety; and (4) effects of speed limits on fuel economy and safety. GRA

N75-33411# Transportation Systems Center, Cambridge, Mass. 21D
STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT. TRUCK AND BUS PANEL REPORT NO. 7 Special Congressional Report, Jun. - Oct. 1974
Harold G. Miller 10 Jan. 1975 112 p refs Sponsored in part by Committee on Commerce (U.S. Senate), Committee on Interstate and Foreign Commerce (U.S. House), and EPA, Washington D.C.
(PB-241777/2; DOT-TSC-OST-75-16) Avail: NTIS HC $5.25; also available in a set of 8 reports as PB-241769-SET HC $29.00

Special consideration is given to the potential improvement of truck and bus fuel economy implementable by the 1980 production year. Vehicles considered are those with gross vehicle weight ratings of 10,000 pounds or more. GRA

N75-33412# Stock Drive Products, Inc., New Hyde Park, N.Y.
HANDBOOK OF STOCK GEARS FEATURING INCH AND METRIC SIZES, TECHNICAL SECTION. CATALOG 75
1975 59 p
(PB-242149/3) Avail: NTIS .MF $2.25; HC $2.95 available from Stock Drive Products, 55 .South Denton Ave., New Hyde Park, N. Y. 11040 CSCL 13I

The technical section of handbook contains information required for design and specification of gears. In addition to the material needed for inch-size gear design, attention was given to the growing demand for metric gears. The portion reproduced is the Technical Section of the Handbook. GRA

N75-33090* Ball Bros. Research Corp., Boulder, Colo.
AEROSPACE LUBRICATION TECHNOLOGY TRANSFER TO INDUSTRIAL APPLICATIONS
Thomas J. Loran and Bill Perrin *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 14 p (For availability see N75-33086 24-12)
CSCL 11H

N75-33091* TRW Systems Group, Redondo Beach, Calif.
A STRUT WITH INFINITELY ADJUSTABLE THERMAL EXPANSIVITY AND LENGTH
Paul T. Nelson *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 10 p (For availability see N75-33086 24-12)
CSCL 20K

N75-33092* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IN-FLIGHT FRICTION AND WEAR MECHANISM
E. J. Devine and H. E. Evans *In its* 9th Aerospace Mech. Symp. 1974 12 p refs (For availability see N75-33086 24-12)
CSCL 14B

N75-33093* Fairchild Space and Electronics Co., Germantown, Md.
METAL WITH A MEMORY PROVIDES USEFUL TOOL FOR SKYLAB ASTRONAUTS
G. A. Smith *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 18 p (For availability see N75-33086 24-12)
CSCL 14B

N75-33098* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PRECISION SIX-METER DEPLOYABLE BOOM FOR THE MARINER-VENUS-MERCURY 1973 MAGNETOMETER EXPERIMENT
Harry F. Burdick *In its* 9th Aerospace Mech. Symp. 1974 13 p refs (For availability see N75-33086 24-12)
CSCL 14B

N75-33100* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NEW CONCEPT FOR ACTUATING SPACE MECHANISMS
William C. Stange *In its* 9th Aerospace Mech. Symp. 1974 9 p ref (For availability see N75-33086 24-12)
CSCL 14B

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N75-33413 Missouri Univ., Rolla.
A STUDY OF SOME LIFE TESTING DISTRIBUTIONS Ph.D. Thesis
Robert Marvin Smith 1975 152 p
Avail: Univ. Microfilms Order No. 75-22310

A life-testing distribution which has the property of possessing a failure rate function is considered that can be U-shaped or exponentially increasing depending on the value of the shape parameter. Generalized least squares type estimators for location-scale distributions were used in the analysis of the exponential-power distribution. Tables are provided for which inferences on the location and scale parameters and on the reliability can be obtained. Relationships between a goodness-of-fit statistic based on a correlation coefficient and known goodness-of-fit statistics are given. Tables of critical values are given for complete and censored samples when the hypothesis to be tested is completely specified or when the composite hypothesis of normality or exponentiality is to be tested. Results are included on simple, closed form estimators for the Weibull or extreme-value distribution. Tables of critical values are provided for making inferences on the location parameter and on reliability.
Dissert. Abstr.

N75-33414# Los Alamos Scientific Lab., N.Mex.
QUANTITATIVE PULSED EDDY CURRENT ANALYSIS
R. A. Morris 1975 20 p refs Presented at 10th Symp. on Nondestructive Evaluation, San Antonio, 23-25 Apr. 1975
(Contract W-7405-eng-36)
(LA-UR-75-595; Conf-750463-1) Avail: NTIS HC $4.00

The potential of pulsed eddy current (PEC) testing for furnishing more information than conventional single-frequency eddy current methods is discussed in terms of analyzing the pulse shape with sufficient precision to produce accurate quantitative results. Ways of digitizing the short pulses encountered in PEC testing are examined and empirical analysis techniques are developed that predict the parameters of simple types of defects. The digitizing technique is described using a computer and either a conventional nuclear ADC or a fast transient analyzer. The computer software used to collect and analyze pulses and some of the results obtained are included.
Author (NSA)

N75-33415# RAND Corp., Santa Monica, Calif.
GETTING 'REAL' DATA FOR LIFE CYCLE COSTING
Marco R. Fiorello Jan. 1975 19 p Presented at the IEEE 1974 Electronics and Aerospace Conf., D. C., 7-9 Oct. 1974
(AD-A010960; P-5345) Avail: NTIS CSCL 15/5

The process of identifying, collecting and using historical data for estimating the life-cycle costs of a weapon system is discussed. The focus is on data-related problems which currently constrain the accuracy and reliability of life-cycle cost estimates. Particular attention is given to the costs of ownership. A case example is provided to illustrate the estimation of life-cycle costs using macro cost data for an operational weapon system. Some of the uncertainties inherent in the data collection and analysis processes are also discussed. Specific recommendations include implementing operationally consistent life-cycle cost estimation procedures, improving weapon system cost visibility in cost data systems, establishing and maintaining a nomenclature directory, implementing better cost allocation rules, anticipation of life-cycle cost decision data requirements, and constructing and maintaining a special data base for life-cycle cost analysis and methodology development. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N75-33416 Polytechnic Inst. of New York.
SHOCK RESPONSE OF A SUBMERGED, RING-REINFORCED, CAPPED CYLINDRICAL SHELL Ph.D. Thesis
Martin Larry Pollack 1975 63 p
Avail: Univ. Microfilms Order No. 75-21396

The response of a submerged stiffened capped cylindrical shell to an engulfing acoustic wave investigated. The shell response is expressed in terms of the in vacuo normal modes of the unstiffened shell, while the fluid interaction loads are approximated through the use of two fluid decoupling schemes (plane wave and doubly asymptotic approximations). The results show good agreement with experimental values obtained for a side-shock of an identical cylindrical structure, closed by heavy end plates instead of the spherical caps. Because of the difference in geometry, correlation at the ends of the cylinder is considerably reduced. Dissert. Abstr.

N75-33417 Drexel Univ., Philadelphia, Pa.
IMPACT STUDY OF LAMINATED COMPOSITE PLATES Ph.D. Thesis
Benjamin Thomas Rodini 1975 155 p
Avail: Univ. Microfilms Order No. 75-21682

The accuracy of plate theory in transient one-dimensional wave propagation problems was studied. Impact experiments were conducted with composite material plates of the same lay-up, and the strain histories at various points on the specimen plate were recorded. These strains were compared with theoretical calculations which took into account wave propagation in both the specimen and the striker. The specimen plates (609.6mm x 355.6mm) were used, each consisted of 50 layers of graphite-epoxy. Each specimen plate was impacted by two different length striker plates (25.4mm x 609.6mm and 76.2mm x 609.6mm). A pendulum impact system was used for two types of impact, an in-plane impact, and a shear-bending impact. The in-plane impact was analyzed with two levels of Mindlin type theory. One level is a first order approximation and the other includes thickness effects; both were obtained from reduction of a higher-order theory. The shear-bending impact was analyzed with the first order theory. Computer codes, based on the method of characteristics, were used to solve numerically the boundary value problems for both impact cases. Dissert. Abstr.

N75-33418 Clemson Univ., S.C.
AN ANALYTICAL INVESTIGATION OF THE EFFECTS OF CRACKS PERPENDICULAR TO A DEBONDED MATERIAL INTERFACE Ph.D. Thesis
William Albert Venezia 1975 148 p
Avail: Univ. Microfilms Order No. 75-22100

Two solutions were developed for the two dimensional problem of bonded linearly elastic half-planes. The first is for two bonded isotropic linearly elastic half-planes of different elastic properties having a crack along the interface as well as a perpendicular crack in one of the half-planes which may intersect the interface crack. The appropriate integral equations were developed through the use of displacement dislocations in conjunction with Mellin transforms. The resulting pair of singular integral equations was solved by obtaining the relationships between these solutions and the weight functions for Chebyshev and Jacobi polynomials. The second solution is for two bonded isotropic linearly elastic half-planes of different elastic properties having a crack along the interface, as well as a perpendicular crack in each of the half-planes, either or both of which may intersect the interface crack. For each solution, numerical results are presented for the stress intensity factors, strain energy release rate, stresses and displacements. A FORTRAN program listing is given for each solution, and sample inputs and outputs are included for aluminum-epoxy material pairs. Dissert. Abstr.

N75-33419 California Univ., Los Angeles.
ELASTIC-PLASTIC ANALYSIS OF ANISOTROPIC PLATES WITH LARGE DEFLECTION Ph.D. Thesis
Manouchehr Motamed Gorji 1975 178 p
Avail: Univ. Microfilms Order No. 75-22625

The large deflection behavior of anisotropic plates beyond the elastic limit was investigated. Two different types of anisotropy are distinguished: crystallographic anisotropy which results from a preferred orientation in crystalline structure of the metals due to plastic deformation, and mechanical anisotropy which is caused by embedding stiff reinforcing fibers in a compatible matrix. The well known Von Karman theory was used to formulate the differential equations of anisotropic thin plates. The inelastic strain and nonlinear terms of lateral displacement are treated as additional applied loads. The inelastic large deflection problem is reduced to a set of two problems: a plane stress problem and a linear plate bending problem. The numerical method of finite element was employed to solve the elastic plane stress problem. The elastic-plastic solutions were obtained by employing suitable plasticity theories and the known solutions of the linear problems through an iteration procedure. A 2024-T351 aluminum alloy plate which exhibits anisotropy in the plastic range was used in the analysis. Dissert. Abstr.

N75-33420 California Univ., Los Angeles.
DYNAMIC ANALYSIS OF ELASTIC MECHANICAL SYSTEMS WITH CLEARANCES Ph.D. Thesis
Terry Norman Gardner 1975 155 p
Avail: Univ. Microfilms Order No. 75-22623

The mathematical model developed for the analysis was based on the use of distributed coordinates or deformation functions. Their use significantly reduces the required number of degrees of freedom, and permits the employment of perturbation coordinates which enhance both the accuracy and the efficiency of the solution. The equations of motion were implemented in a numerical integration computer code. Results are presented for a single link, the impact beam model, excited by unidirectional motion. The expected drastic increase in bearing forces due to clearances is seen when the link is rigid. Correlation was made with previously published work. The subsequent addition of flexibility in the link causes significant reduction in peak bearing forces for all practical operating speeds. It is observed that peak forces always occur just after the nominal acceleration changes sign. A Scotch yoke and a four-bar mechanism were studied as typical planar mechanisms. The bearing forces of these machines show similar trends to those of the impact beam model. Dissert. Abstr.

N75-33421 Mississippi Univ., University.
CONTACT PROBLEMS OF ELASTIC BODIES WITH FINITE FRICTION INVOLVING SLIP AND SEPARATION Ph.D. Thesis
Suman Dasgupta 1975 114 p
Avail: Univ. Microfilms Order No. 75-21546

The effect of friction was studied in detail for rectangular bodies subjected to compression and sliding by rigid planes. The problem of finite cylinder with smooth indenting sleeves was also studied. In all the problems, use was made of expansion in terms of complex-valued Papkovich-Fadle eigenfunctions and calculus of residue to obtain Fredholm integral equations, suitable for numerical solution. The general case of the axisymmetric shrink fit problems of a solid elastic cylinder whose ends are free from tractions is formulated in terms of the Fredholm integral equation of the second kind. The plane strain compression of an elastic rectangle by rigid, rough planes with finite coefficient of friction between the surfaces is considered. The plane strain compression and sliding of an elastic rectangle is considered whose one set of parallel edges are free from tractions. Dissert. Abstr.

N75-33422 Polish Academy of Sciences, Warsaw.
OPTIMALIZATION AND CALCULATION OF BOUNDARY PLATE LOAD-CARRYING CAPACITY WITH THE USE OF LINEAR PROGRAMMING [OPTYMALIZACJA I OBLICZANIE NOSNOSCI GRANICZNEJ PLYT ZA POMOCA PROGRAMOWANIA LINIOWEGO]
Adam Borkowski 30 Jan. 1975 53 p refs In POLISH
Avail: Issuing Activity

Existing methods for investigating technically orthotropic plates are discussed. A computer program written in ALGOL for the ODRA 1204 computer is described; it is used for optimalizing reinforcement and calculation of wear of reinforced concrete boundary plates. Transl. by M.J.S.

N75-33423 Polish Academy of Sciences, Warsaw.
PROBLEM OF DYNAMIC CONTACT IN A BAR-GRID SYSTEM WITH REGARD TO THE BAR'S PLASTICITY [ZAGADNIENIE DYNAMICZNEGO KONTAKTU W UKLADZIE PRET-BELKA Z UWZGLEDNIENIEM PLASTYCZNOSCI PRETA]
Stefan Kowalski 26 Feb. 1975 130 p refs In POLISH
Avail: Issuing Activity

An example is presented of the dynamic contact problem in which the wave theory was used. Lateral impacts of the infinite elastic beam with a finite elastic and elastoplastic rod (Prandtl model with reinforcement) are considered which establish ideal contact at the collision point. Plastic collisions are found to be ideally smooth and rigid with ideal conservation of the perpendicular direction of the bar to the beam axis. Transl. by M.J.S.

N75-33424 Waterloo Univ. (Ontario). Solid Mechanics Div.
SHEAR STRENGTH OF REINFORCED CONCRETE BEAMS WITH SHORT SHEAR SPANS
S. M. Fereig and K. N. Smith Feb. 1974 45 p refs
(Paper-126) Avail: Issuing Activity

The effect was studied of various supporting and loading conditions on the cracking behavior, major crack width, deflection, arch action, and ultimate shear strength of beams with short shear spans. Various different loading states were studied including loads applied to the top surfaces of beams, loads applied via shear on the side of a beam in the compression zone, and loads applied via shear on the side of a beam in the tension zone. Supporting conditions include the case of simple bearing on the underside and also the case of the reaction applied by shear on the sides of the beam. For each combination of loading and supporting modes considered, three ratios of shear span to depth were investigated. To examine the behavior prior to cracking, the finite element method was used to compute the pattern of stresses: shear stresses, longitudinal stresses, and transverse and principal stresses. Behavior after cracking was studied in an experimental program involving 18 beams. Concrete strains, steel strains, deflections, and crack widths were measured at each increment of load, and crack patterns and crack propagation diagrams are reported. Author

N75-33425 Waterloo Univ. (Ontario). Solid Mechanics Div.
STOCHASTIC MODELS FOR FATIGUE FAILURE OF MATERIALS
S. K. Srinivasan (Indian Inst. of Tech., Madras) Jun. 1974 22 p refs
(Rept-28) Avail: Issuing Activity

The idea of cumulative damage in materials is discussed and quantified through physical considerations. Fatigue is assumed to occur when the cumulative damage exceeds a certain fixed level. On this basis a simple probabilistic model is presented. Recent attempts at a fully quantitative theory of fatigue through the formation and propagation of cracks in the samples are outlined. With the crack length as the main criterion, the theory of fatigue is developed through some models. Finally, attempts were made to bring to the fore the analoy with the excitation in neuro-physiology. Author

N75-33426 Waterloo Univ. (Ontario). Solid Mechanics Div.
INELASTIC BEHAVIOUR OF PRESTRESSED CONCRETE STRUCTURAL MEMBERS
M. Balabanian, S. K. Ghosh, and M. Z. Cohn Apr. 1974 29 p refs
(Paper-127) Avail: Issuing Activity

An attempt is made to verify the applicability of limit design theories to prestressed concrete structures, by determining the degree of moment redistribution occurring in such structures. Tests carried out on 2-span bonded prestressed concrete beams are reported. The two main test variables were: (1) the amount of prestressing steel and (2) the depths (eccentricities) of prestressing cables at the critical sections. The behavior of the

test beams, as predicted by various analytical methods, is compared with their actual behavior in the experiments. Almost full moment redistribution is observed in all the tested beams. Within the ranges considered, the test variables do not have a significant effect on the degree of moment redistribution. It appears that limit design methods are applicable to prestressed concrete continuous beams. Author

N75-33427+ Engineering Sciences Data Unit, London (England).
DESIGN FOR MAXIMUM STRUCTURAL EFFICIENCY. ISOTROPIC SANDWICH PANEL UNDER UNIAXIAL COMPRESSION
Jun. 1975 22 p
(ESDU-75006) Copyright. Avail: NTIS HC $122.50

Design charts and procedures are provided for obtaining sandwich panels of maximum structural efficiency by the correct choice of core and face plate thickness and material properties for application to aircraft wings, tailplane panels, and prefabricated panels for buildings. The data are applicable to long panels loaded on either the long or short sides, with or without limitations on the face plate stress, and/or the face plate or core thicknesses. Author

N75-33428*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL EVALUATION OF TWO 36 INCH BY 47 INCH GRAPHITE/EPOXY SANDWICH SHEAR WEBS
Harold G. Bush Oct. 1975 54 p refs
(NASA-TM-X-72767) Avail: NTIS HC $4.25 CSCL 20K

The design is described and test of two large (36 in. x 47 in.) graphite/epoxy sandwich shear webs. One sandwich web was designed to exhibit strength failure of the facings at a shear load of 7638 lbs/in., which is a characteristic loading for the space shuttle orbiter main engine thrust beam structure. The second sandwich web was designed to exhibit general instability failure at a shear load of 5000 lbs/in., to identify problem areas of stability critical sandwich webs and to assess the adequacy of contemporary analysis techniques. Author

N75-33429*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARATIVE THERMAL FATIGUE RESISTANCES OF TWENTY-SIX NICKEL AND COBALT BASE ALLOYS
Peter T. Bizon and David A. Spera Washington Oct. 1975 40 p refs
(NASA-TN-D-8071; E-8305) Avail: NTIS HC $3.75 CSCL 11F

Thermal fatigue resistances were determined from fluidized bed tests. Cycles to cracking differed by almost three orders of magnitude for these materials with directional solidification and surface protection of definite benefit. The alloy-coating combination with the highest thermal fatigue resistance was directionally solidified NASA TAZ-8A with an RT-XP coating. It oxidation resistance was excellent, showing almost no weight change after 15 000 fluidized bed cycles. Author

N75-33430# Waterloo Univ. (Ontario). Transport Group.
THE PREDICTION OF PERMANENT DEFORMATION IN ASPHALT CONCRETE PAVEMENTS
Jack Morris Sep. 1973 320 p refs
Avail: NTIS HC $9.25

Existing permanent deformation design technology was examined and it was shown that it is incapable of predicting permanent deformation. Two recently proposed techniques, aimed at overcoming this deficiency, are considered but found to be inadequate. A procedure referred to as the simulative statistically-based approach is advanced and described. Experimental equipment, testing procedures, and a statistically-based experimental program were developed to characterize a field asphalt concrete mixture. The results of the laboratory experimental program were employed to predict the permanent deformation of a number of Brampton Test Road full-depth asphalt sections. Excellent agreement between predicted and measured permanent deformations was found. The nature and distribution of permanent deformation throughout the asphalt concrete layer as shown to be largely a function of the radial stress distribution. Author

N75-33431*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NUMERICAL ANALYSIS AND PARAMETRIC STUDIES OF THE BUCKLING OF COMPOSITE ORTHOTROPIC COMPRESSION AND SHEAR PANELS
Jerrold M. Housner and Manuel Stein Washington Oct. 1975 103 p
(NASA-TN-D-7996; L-10083) Avail: NTIS HC $5.25 CSCL 20K

A computer program is presented which was developed for the combined compression and shear of stiffened variable thickness orthotropic composite panels on discrete springs: boundary conditions are general and include elastic boundary restraints. Buckling solutions are obtained by using a newly developed trigonometric finite difference procedure which improves the solution convergence rate over conventional finite difference methods. The classical general shear buckling results which exist only for simply supported panels over a limited range of orthotropic properties, were extended to the complete range of these properties for simply supported panels and, in addition, to the complete range of orthotropic properties for clamped panels. The program was also applied to parametric studies which examine the effect of filament orientation upon the buckling of graphite-epoxy panels. These studies included an examination of the filament orientations which yield maximum shear or compressive buckling strength for panels having all four edges simply supported or clamped over a wide range of aspect ratios. Panels with such orientations had higher buckling loads than comparable, equal weight, thin skinned aluminum panels. Also included among the parameter studies were examinations of combined axial compression and shear buckling and examinations of panels with rotational elastic edge restraints. Author

N75-33432# Japan Atomic Energy Research Inst., Tokyo.
LIVIELA: VISCO-ELASTIC STRESS ANALYSIS PROGRAM USING FINITE ELEMENT METHOD
T. Ikushima Nov. 1974 77 p refs In JAPANESE; ENGLISH summary
(JAERI-M-5880) Avail: International Atomic Energy Agency, P. O. Box 590A-1011, Vienna, Austria MF $0.65

Computer program LIVIELA has been prepared for analyzing the viscoelastic stress of two dimensional or axis-symmetric structures is described. Features of the program are: (1) calculable items are temperature, and stress due to irradiation strain, thermal strain, external load, displacement, pressure and their combination; (2) it can be applied to the transversely anisotropic materials; (3) it can treat time dependent material property; (4) it is considered to make easy input data and mesh generation of elements; (5) numerical analysis is performed by the displacement method and the successive overrelaxation method; (6) calculation results can be represented with a graphic plotter; (7) limitations of the calculation are maximum elements 1200, maximum nodes 800, maximum materials 40, maximum calculation steps 60. The program is written in FORTRAN 4 and used with FACOM 230-60, and usable memory is about 100 k words. Author (NSA)

N75-33433# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
ELASTICITY THEORY OF DISLOCATIONS [ELASTICITEITS-THEORIE VAN DISLOCATIES]
J. A. Steketee Mar. 1974 83 p refs In DUTCH
(VTH-179) Avail: NTIS HC $4.75

Based on the work of Cauchy, Navier, Somigliana, and Volterra, an elasticity theory of dislocations was developed in which Navier equations play a similar role as the Laplace equations in the potential theory. Topics dealt with include the classical elasticity theory principle, the displacement field in an infinite medium, the Somigliana tensor, an example of a Somigliana, Betti theorem, the Griffith crack, the Burgers theorems, deformation energy associated with a dislocation, Volterra dislocations, cracks and fracture mechanics and, geophysical aspects. ESA

N75-33434# Institut Franco-Allemand de Recherches, St. Louis (France).
SHOCK WAVE DAMPING IN RELATION TO MATERIALS DYNAMIC PROPERTIES [AMORTISSEMENT D'UNE ONDE

DE CHOC EN LIAISON AVEC LES PROPRIETES DYNAMIQUES DES MATERIAUX]
M. Samirant 26 Nov. 1974 19 p In FRENCH Presented at the colloq. on "Les Methodes d'Etudes et Simulation des Chocs', Lyon, Oct. 1974
(ISL-CO-32/74) Avail: NTIS HC $3.25

Shock damping by porous materials in relation to the material dynamic properties is discussed. Static measurements and forecasting of dynamic characteristics are detailed with regard to shock generation measuring method, dampers classification, and analysis of the expansion phase. The user of shock reverberation to measure the expansion adiabatics point by point is discussed. ESA

N75-33435# Army Construction Engineering Research Lab., Champaign, Ill.
THE DESIGN OF A PLASTIC STRUCTURAL SYSTEM (ILIR)
R. G. Merritt Apr. 1975 99 p
(AD-A011224; CERL-TR-M-121) Avail: NTIS CSCL 13/13

The report considers the use of plastic materials in the design of new structural systems. It presents a complete design for a 100-man bathhouse to be constructed of plastics. The preliminary design is based upon a uniformly distributed load of 50 lb/sq ft with a safety factor of design. Also included are a material selection scheme for the design of such facilities, a design summary, and a discussion of current methods of testing specimens made of plastic materials. GRA

N75-33436# Technion - Israel Inst. of Tech., Haifa. Dept. of Materials Engineering.
DYNAMIC INELASTIC BEHAVIOR OF MATERIALS Scientific Interim Report, 1 Dec. 1973 - 30 Nov. 1974
Sol R. Bodner Jan. 1975 13 p
(Grant AF-AFOSR-2607-74; AF Proj. 9782)
(AD-A010495; AFOSR-75-0781TR) Avail: NTIS CSCL 11/4

The principal subjects investigated were the development and application of constitutive equations to represent material behavior for strain rate dependent and strain hardening plasticity and also for rate dependent anelasticity, the theoretical and experimental analysis of oblique perforation of metal plates by projectiles, and the experimental study of acoustic emission of loaded fibre composite materials. The accomplishments of the program are discussed and the proposed directions of future research are indicated. GRA

N75-33437# California Univ., Berkeley. Fire Research Group.
BEHAVIOR OF REINFORCED CONCRETE UNDER VARIABLE ELEVATED TEMPERATURES
R. Iding, J. Lee, and B. Bresler Apr. 1975 79 p refs
(Grant NSF GI-43)
(PB-242441/4; UCB-FRG-75-8) Avail: NTIS HC $4.75 CSCL 13C

Results of a pilot study on the behavior of reinforced concrete exposed to elevated temperatures are reported. A series of experiments was conducted in which the thermal and structural responses of unreinforced and reinforced concrete prisms to various combinations of heating and axial compression loading cycles were measured. Exposures of up to 600 F (316 C) were studied using equipment developed for this experimental program. Computer programs were used to simulate the experiments mathematically; these numerical solutions and the results of the experimental program are compared. Of particular interest was the validity of the mathematical models in representing heat conduction and concrete cracking and crack closing due to thermal effects and axial compression. GRA

N75-33438# Wisconsin Univ., Madison. Mathematics Research Center.
CREEP BUCKLING OF IMPERFECT COLUMNS Technical Summary Report
N. C. Huang May 1975 29 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A011016; MRC-TSR-1544) Avail: NTIS CSCL 20/11

In this paper, a study of the creep buckling of two simple columns with geometrical imperfections associated with finite deformations has been made. The material property of the column is considered to satisfy a power law for creep deformation and a generalized Ramberg-Osgood relation for noncreep deformation. It is found that creep buckling at a finite time would exist only when the magnitude of the load is between two bounds. GRA

N75-33439*# National Bureau of Standards, Washington, D.C.
IMPROVED ULTRASONIC STANDARD REFERENCE BLOCKS Interim Report, 1 Jan. 1974 - 31 Dec. 1974
D. G. Eitzen Apr. 1975 84 p refs Sponsored in part by NASA and Army Mater. and Mech. Res. Center
(Contract F33615-74-M-6752)
(NASA-CR-119098; COM-75-10690/6) Avail: NTIS HC $4.75 CSCL 14B

A program to improve the quality, reproducibility and reliability of nondestructive testing through the development of improved ASTM-type ultrasonic reference standards is described. Reference blocks of aluminum, steel, and titanium alloys were considered. Equipment representing the state-of-the-art in laboratory and field ultrasonic equipment was obtained and evaluated. Some RF and spectral data on ten sets of ultrasonic reference blocks were taken as part of a task to quantify the variability in response from nominally identical blocks. Techniques for residual stress, preferred orientation, and microstructural measurements were refined and are applied to a reference block rejected by the manufacturer during fabrication in order to evaluate the effect of metallurgical condition on block response. GRA

N75-33440# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
THE TORSIONAL RESPONSE OF A SUSPENSION BRIDGE STIFFENING TRUSS MODEL TO TURBULENCE AND TO AN UPSTREAM OBSTACLE Partial Report, Oct. 1972 - Dec. 1974
T. A. Reinhold, H. W. Tieleman, and F. J. Maher Dec. 1974 22 p refs
(Grant NSF GK-35801)
(PB-242274/9; VPI-E-74-28) Avail: NTIS HC $3.25 CSCL 13B

A 1:64 scale section model of a recently constructed suspension bridge was tested in smooth flow and turbulent flow with and without an upstream obstacle. Testing was limited to determination of the aerodynamic damping on a model confined to single-degree of freedom torsional motion. The turbulent atmosphere was generated by use of a uniform grid at the test section entrance. The upstream obstacle selected was an almost exact 1:64 replica of a cable stayed bridge that was basically a flat plate on a narrower box. GRA

N75-33441# Oak Ridge National Lab., Tenn.
APPENDIX: MATERIAL PROPERTY DATA FOR ELASTIC-PLASTIC-CREEP ANALYSIS OF BENCHMARK PROBLEMS
J. M. Corum 1975 16 p refs Presented at the 2d ASME Natl. Congr. on Pressure Vessels and Piping, San Francisco Sponsored by ERDA
(CONF-750617-5) Avail: NTIS HC $4.00

A summary is presented of the applicable material property data required as input to conventional elastic-plastic and elastic-plastic-creep analyses of the experimental benchmark problems described. These data were used in an exemplary inelastic analyses. The data provided include elastic constants and a monotonic stress-strain curve at room temperature; elastic constants, cyclic stress-strain curves, and physical properties for the 800 to 1100 F temperature range, and uniaxial, constant stress creep data for a temperature of 1100 F. Author (NSA)

N75-33442# Pennsylvania State Univ., University Park. Applied Research Lab.
TRANSMISSIBILITY ACROSS SIMPLY SUPPORTED RECTANGULAR, THIN PLATES WITH LOADING MASSES OR RIBS
John B. Ochs 4 Mar. 1975 121 p refs
(Contract N00017-73-C-1418)
(AD-A010551; TM-75-43) Avail: NTIS CSCL 20/11

The transmissibility across simply supported, rectangular, thin plates has been determined experimentally and compared, where possible, with the results of existing theoretical calculations. As measured, transmissibility is the magnitude of the ratio of the central sinusoidal acceleration of the plates to the rigid body sinusoidal acceleration of their boundaries. Comparison has been

made between the results of transmissibility measurements across plates with central loading masses, plates with seven different straight-rib configurations, and plates with three concentric circular-rib configurations. The added mass in each case equalled the plate mass so that the effectiveness of the added mass in reducing transmissibility could be evaluated as a function of its geometry. GRA

N75-33443# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
STABILITY OF AN ELASTIC CUBE UNDER DEAD LOADING: TWO EQUAL FORCES
Kn. N. Sawyers May 1975 43 p refs
(Contract N00014-67-A-0370-0001)
(AD-A010559; CAM-100-22) Avail: NTIS CSCL 20/12

A cube of incompressible neo-Hookean material undergoes a pure homogeneous deformation and is held in equilibrium by three specified pairs of equal and opposite forces, two of which are the same, applied normally to its faces and uniformly distributed over them. The possible equilibrium states are determined and the stability of each is studied with respect to arbitrary superposed infinitesimal deformations. The stability limits are found to be different from those obtained when only infinitesimal deformations having the same principal directions as those of the basic equilibrium state are considered. The differences arise from rotational and shearing types of instabilities that may occur in the general case. A critical inference is drawn concerning the nature of the dead loading conditions employed. GRA

N75-33105* Lockheed Missiles and Space Co., Sunnyvale, Calif.
LOADCELL SUPPORTS FOR A DYNAMIC FORCE PLATE
C. W. Keller, L. M. Musil, and John L. Hagy (Shriners Hospital for Crippled Children) *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 17 p refs (For availability see N75-33086 24-12)
CSCL 20K

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N75-33444*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: NON-US STANDARD CATALOG NO. N-30
28 Feb. 1975 55 p
(NASA-TM-X-72891) Avail: NTIS HC $4.25; EROS Data Center, Sioux Falls, S. D., 57198 HC $1.25 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska, and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Author

N75-33445*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: NON-US STANDARD CATALOG NO. N-31
31 Mar. 1975 110 p
(NASA-TM-X-72892) Avail: NTIS HC $5.25; EROS Data Center, Sioux Falls, S. D., 57198 HC $1.25 CSCL 05B
For abstract, see N75-33444.

N75-33446*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: NON-US STANDARD CATALOG NO. N-32
30 Apr. 1975 93 p
(NASA-TM-X-72893) Avail: NTIS HC $4.75; EROS Data Center, Sioux Falls, S. D., 57198 HC $1.25 CSCL 05B
For abstract, see N75-33444.

N75-33447*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TESTS AND COMPARISONS OF SATELLITE DERIVED GEOIDS WITH SKYLAB ALTIMETER DATA
J. G. Marsh (Natl. Ocean Survey, Rockville, Md.), B. C. Douglas, S. Vincent (Wolf Res. and Develop. Corp., Riverdale, Md.), and D. M. Walls (Wolf Res. and Develop. Corp., Riverdale, Md.) Jul. 1975 25 p refs Presented at the Ann. Meeting of the Am. Geophysical Union, Washington, D. C., 16-20 Jun. 1975 Submitted for publication
(NASA-TM-X-70985; X-921-75-176) Avail: NTIS HC $3.25 CSCL 08E

The SKYLAB-193 radar altimeter was operated nearly continuously around the world on January 31, 1974. This direct measurement of the sea surface topography provided an independent basis for the evaluation of global geoids computed from satellite derived gravity models. The differences between the altimeter geoid and the satellite geoids were as large as 25 meters with rms values ranging from 8 to 10 meters. These differences also indicated a systematic long wavelength variation (approximately 100 deg) not related to error in the SKYLAB orbits. Truncation of the models to degree and order eight did not eliminate the long wavelength variation, but in every case the rms agreement between satellite and altimeter geoids was improved. Orbits computed with the truncated models were in contrast found to be inferior to those computed using the complete models. Author

N75-33448 California Univ., Berkeley.
MULTISTAGE VARIABLE PROBABILITY SAMPLING: THEORY AND USE IN ESTIMATING TIMBER RESOURCES FROM SPACE AND AIRCRAFT PHOTOGRAPHY Ph.D. Thesis
Philip Gendron Langley 1975 111 p
Avail: Univ. Microfilms Order No. 75-22538

The use of a forest resources information system containing data concerning the resource base is discussed. Multistage variable probability sampling is suggested as a technique for utilizing the data to stratify the population and to generate supplementary variables for use in sampling for specific components of the resource base. As new surveys were undertaken, portions of the resource base would be strengthened, providing better data for subsequent surveys. A guideline was developed for the optimal allocation of samples to various stages of multistage sample survey with variable probabilities. The derivation of the multistage theory and selected examples of the use of the technique, as well as the results obtained from trial timber surveys, are also included. The method appears to work well under the conditions described. Dissert. Abstr.

N75-33449*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: US STANDARD CATALOG NO. U-31
31 Mar. 1975 102 p
(NASA-TM-X-72881) Avail: NTIS HC $5.25; EROS Data Center, Sioux Falls, S. D., 57198 HC $1.25 CSCL 05B
For abstract, see N75-33444.

N75-33450*# South Dakota State Univ., Brookings. Remote Sensing Inst.
DEVELOP TECHNIQUES AND PROCEDURES, USING MULTISPECTRAL SYSTEMS, TO IDENTIFY FROM REMOTELY SENSED DATA THE PHYSICAL AND THERMAL CHARACTERISTICS OF PLANTS AND SOIL Monthly Progress Report, May 1975
Victor I. Myers, Principal Investigator 20 Jun. 1975 2 p
EREP

(Contract NAS9-13337)
(E75-10395; NASA-CR-144390) Avail: NTIS HC $3.25 CSCL 08M

There are no author-identified significant results in this report.

N75-33451*# South Dakota State Univ., Brookings. Remote Sensing Inst.
DEVELOP TECHNIQUES AND PROCEDURES, USING MULTISPECTRAL SYSTEMS TO IDENTIFY FROM REMOTELY SENSED DATA THE PHYSICAL AND THERMAL CHARACTERISTICS OF PLANTS AND SOIL Monthly Progress Report, Jun. 1975
Victor I. Myers, Principal Investigator 20 Jul. 1975 2 p EREP
(Contract NAS9-13337)
(E75-10396; NASA-CR-143389) Avail: NTIS HC $3.25 CSCL 05B

There are no author-identified significant results in this report.

N75-33452*# South Dakota State Univ., Brookings. Remote Sensing Inst.
DEVELOPMENT TECHNIQUES AND PROCEDURES, USING MULTISPECTRAL SYSTEMS, TO IDENTIFY FROM REMOTELY SENSED DATA THE PHYSICAL AND THERMAL CHARACTERISTICS OF PLANTS AND SOIL Monthly Progress Report, Jul. 1975
Victor I. Myers, Principal Investigator 20 Aug. 1975 2 p EREP
(NAS9-13337)
(E75-10397; NASA-CR-143388) Avail: NTIS HC $3.25 CSCL 05B

There are no author-identified significant results in this report.

N75-33453*# National Oceanic and Atmospheric Administration, Miami, Fla. Environmental Research Labs.
REMOTE SENSING OF OCEAN CURRENT BOUNDARY LAYER Monthly Report, Jun. 1975
George A. Maul, Principal Investigator Jun. 1975 2 p EREP
(Contract NASA Order T-4713-B)
(E75-10398; NASA-CR-143391; Rept-24) Avail: NTIS HC $3.25 CSCL 08C

There are no author-identified significant results in this report.

N75-33454*# National Oceanic and Atmospheric Administration, Miami, Fla. Environmental Research Labs.
REMOTE SENSING OF OCEAN CURRENT BOUNDARY Monthly Report, Jul. 1975
George A. Maul, Principal Investigator Jul. 1975 2 p EREP
(Contract NASA Order T-4713-B)
(E75-10399; NASA-CR-143392; Rept-25) HC $3.25 CSCL 08C

There are no author-identified significant results in this report.

N75-33455*# National Oceanic and Atmospheric Administration, Miami, Fla. Environmental Research Labs.
REMOTE SENSING OF OCEAN CURRENT BOUNDARY LAYER Monthly Report, Aug. 1975
George A. Maul, Principal Investigator Aug. 1975 2 p EREP
(Contract NASA Order T-4713-B)
(E75-10400; NASA-CR-143393; Rept-26) Avail: NTIS HC $3.25 CSCL 08C

There are no author-identified significant results in this report.

N75-33456*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
LAND USE MAPPING IN ERIE COUNTY, PENNSYLVANIA: A PILOT STUDY Interim Report
George J. McMurtry, Gary W. Petersen, Principal Investigators, and G. A. May Dec. 1974 4 p refs ERTS
(Contract NAS5-23133)
(E75-10401; NASA-CR-143394; ORSER-SSEL-TR-24-74) Avail: NTIS HC $3.25 CSCL 08B

The author has identified the following significant results. A pilot study was conducted to determine the feasibility of mapping land use in the Great Lakes Basin area utilizing ERTS-1 data. Small streams were clearly defined by the presence of trees along their length in predominantly agricultural country. Field patterns were easily differentiated from forested areas; dairy and beef farms were differentiated from other farmlands, but no attempt was made to identify crops. Large railroad lines and major highway systems were identified. The city of Erie and several smaller towns were identified, as well as residential areas between these towns, and docks along the shoreline in Erie. Marshes, forests, and beaches within Presque Isle State Park were correctly identified, using the DCLUS program. Bay water was differentiated from lake water, with a small amount of misclassification.

N75-33457*# Oslo Univ. (Norway).
HYDROLOGICAL INVESTIGATIONS IN NORWAY Quarterly Report
Johnny Skorve, Principal Investigator 28 Aug. 1975 2 p
Sponsored by NASA ERTS
(E75-10402; NASA-CR-143395) Avail: NTIS HC $3.25 CSCL 05B

There are no author-identified significant results in this report.

N75-33458*# Technische Universitaet, Clausthal-Zellerfeld (West Germany).
MAPPING OF LITHOLOGIC AND STRUCTURAL UNITS USING MULTISPECTRAL IMAGERY Final Report, Aug. 1973 - Mar. 1974
Peter Kronberg, Principal Investigator Apr. 1974 32 p refs Presented at German Geol. Soc. Fall Meeting, Oct. 1973 and at the ESRO-Symp. on European Earth Resources Experiments, Frascati, Italy, Feb. 1974 and at the Intern. Afar-Symp., Bad Bergzabern, West Germany, Apr. 1974 Submitted for publication
Sponsored by NASA EREP
(E75-10403; NASA-CR-144396; Rept-3) Avail: NTIS HC $3.75 CSCL 08B

The author has identified the following significant results. ERTS-1 MSS imagery covering the Afar-Triangle/Ethiopia and adjacent regions (Ethiopian Plateau, Somali Plateau, and parts of Yemen and Saudi Arabi) was applied to the mapping of lithologic and structural units of the test area at a scale 1:1,000,000. Results of the geological evaluation of the ERTS-1 imagery of the Afar have proven the usefullness of this type of satellite data for regional geological mapping. Evaluation of the ERTS images also resulted in new aspects of the structural setting and tectonic development of the Afar-Triangle, where three large rift systems, the oceanic rifts of the Red Sea and Gulf of Aden and the continental East African rift system, seem to meet each other. Surface structures mapped by ERTS do not indicate that the oceanic rift of the Gulf of Aden (Sheba Ridge) continues into the area of continental crust west of the Gulf of Tadjura. ERTS data show that the Wonji fault belt of the African rift system does not enter or cut through the central Afar. The Aysha-Horst is not a Horst but an autochthonous spur of the Somali Plateau.

N75-33459*# Bureau of Reclamation, Denver, Colo.
USE OF THE LANDSAT-2 DATA COLLECTION SYSTEM IN THE COLORADO RIVER BASIN WEATHER MODIFICATION PROGRAM Progress Report, 1 Apr. - 30 Jun. 1975
Archie M. Kahan, Principal Investigator 30 Jun. 1975 6 p ERTS
(Contract NASA Order S-70243-AG-8)
(E75-10404; NASA-CR-143397) Avail: NTIS HC $3.25 CSCL 04B

The author has identified the following significant results. Operation of the LANDSAT data collection system continues to indicate that the network is of practical means to obtain data in near real time to aid in forecasting and control of weather modification operations. Tests of the wind averaging circuit development indicate that the methodology is feasible.

N75-33460*# Norwegian Water Resources and Electricity Board, Oslo.
HYDROLOGICAL INVESTIGATIONS IN NORWAY Quarterly

Report, 1 Apr. - Aug. 1975
Helge A. Oedegaard, Principal Investigator 1 Aug. 1975 5 p Sponsored by NASA ERTS
(E75-10405; NASA-CR-143398) Avail: NTIS HC $3.25 CSCL 05B

There are no author-identified significant results in this report.

N75-33461*# Nebraska Univ., Lincoln. Conservation and Survey Div.
APPLICATION OF LANDSAT IMAGERY IN LAND USE INVENTORY AND CLASSIFICATION IN NEBRASKA Progress Report, 10 Jun. - 10 Sep. 1975
Marvin P. Carlson, Principal Investigator and Paul M. Seevers 10 Sep. 1975 6 p ERTS
(Contract NAS5-20814)
(E75-10406; NASA-CR-143399; Rept-2) Avail: NTIS HC $3.25 CSCL 08B

There are no author-identified significant results in this report.

N75-33462*# National Oceanic and Atmospheric Administration, Washington, D.C.
EVALUATION OF LANDSAT-2 DATA FOR SELECTED HYDROLOGIC APPLICATIONS Progress Report
Donald R. Wiesnet, David F. McGinnis, Jr., Principal Investigators, and Michael C. McMillan 6 Dec. 1975 3 p ERTS
(Contract NAS5-53991A)
(E75-10407; NASA-CR-143400) Avail: NTIS HC $3.25 CSCL 08H

There are no author-identified significant results in this report.

N75-33463*# Mississippi Test Facility, Bay St. Louis.
APPLICATION OF REMOTE SENSING FOR FISHERY RESOURCE ASSESSMENT AND MONITORING Progress Report, 1-31 Jul. 1975
Kenneth Savastano, Principal Investigator 31 Jul. 1975 3 p refs EREP
(Contract NASA Order T-8217-B)
(E75-10408; NASA-CR-143401; PR-19) Avail: NTIS HC $3.25 CSCL 08A

There are no author-identified significant results in this report.

N75-33464*# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
LANDSAT APPLICATION OF REMOTE SENSING TO SHORELINE FROM ANALYSIS Quarterly Report
Robert Dolan, Principal Investigator and Jeffrey Heywood 15 Aug. 1975 20 p ERTS
(Contract NAS5-20999)
(E75-10409; NASA-CR-143402) Avail: NTIS HC $3.25 CSCL 08B

There are no author-identified significant results in this report.

N75-33465*# International Inst. for Aerial Survey and Earth Sciences, Enschede (Netherlands).
EVALUATION OF EREP TECHNIQUES FOR GEOLOGICAL MAPPING: SUMMARY STATEMENTS
H. E. C. vanderMeerMohr and G. S. Srivastava, Principal Investigators Aug. 1975 4 p ref Sponsored by NASA EREP
(E75-10410; NASA-CR-143403) Avail: NTIS HC $3.25 CSCL 08B

There are no author-identified significant results in this report.

N75-33466*# California Earth Science Corp., Santa Monica.
FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGES, SOUTHERN CALIFORNIA Monthly Progress Report, Sep. 1975
Paul M. Merifield, Principal Investigator Sep. 1975 2 p ref EREP
(Contract NAS2-7698)
(E75-10411; NASA-CR-143404; MPR-27) Avail: NTIS HC $3.25 CSCL 08E

There are no author-identified significant results in this report.

N75-33467*# Army Engineer District, San Francisco, Calif.
[REMOTE SENSING OF SAN PABLO BAY AND SANTA BARBARA CHANNEL ISLANDS] Progress Report, 1 Jun. - 31 Aug. 1975
Douglas M. Pirie and David D. Steller, Principal Investigators (ESCA-Tech Corp., Long Beach, Calif.) 5 Sep. 1975 2 p ERTS
(NASA Order S-54062-A)
(E75-10412; NASA-CR-143405) Avail: NTIS HC $3.25 CSCL 08B

There are no author-identified significant results in this report.

N75-33468*# National Ocean Survey, Rockville, Md.
ANALYTIC AEROTRIANGULATION UTILIZING SKYLAB EARTH TERRAIN CAMERA (S-190B) PHOTOGRAPHY Final Report
Morton Keller, Principal Investigator Jul. 1975 105 p refs EREP
(Contract NASA Order T-4110-B)
(E75-10413; NASA-CR-144387) Avail: NTIS HC $5.25 CSCL 08B

The author has identified the following significant results. Inherent errors in using nonmetric Skylab photography and office-identified photo control made it necessary to perform numerous block adjustment solutions involving different combinations of control and weights. The final block adjustment was executed holding to 14 of the office-identified photo control points. Solution accuracy was evaluated by comparing the analytically computed ground positions of the withheld photo control points with their known ground positions and also by determining the standard errors of these points from variance values. A horizontal position RMS error of 15 meters was attained. The maximum observed error in position at a control point was 25 meters.

N75-33469*# Mississippi State Univ., Mississippi State. Inst. for Environmental Studies.
A STUDY OF THE APPLICATION OF SKYLAB EREP S-192 DATA TO LAND CLASSIFICATION IN THE MISSISSIPPI DELTA ALLUVIAL PLAINS REGION Final Report, Apr. 1973 - Sep. 1975
C. W. Bouchillon, Principal Investigator Sep. 1975 50 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13363)
(E75-10414; NASA-CR-144402) Avail: NTIS HC $3.75 CSCL 08B

There are no author-identified significant results in this report.

N75-33470*# Federal Geological Survey, Hanover (West Germany).
MULTIDISCIPLINARY GEOSCIENTIFIC EXPERIMENTS IN CENTRAL EUROPE Final Report, Oct. 1972 - Sep. 1974
Dieter Bannert, Principal Investigator Sep. 1974 170 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(E75-10415; NASA-CR-143412; Rept-2) Avail: NTIS HC $6.25 CSCL 08B

The author has identified the following significant results. Studies were carried out in the fields of geology-pedology, coastal dynamics, geodesy-cartography, geography, and data processing. In geology-pedology, a comparison of ERTS image studies with extensive ground data led to a better understanding of the relationship between vegetation, soil, bedrock, and other geologic features. Findings in linear tectonics gave better insight in orogeny and ore deposit development for prospecting. Coastal studies proved the value of ERTS images for the updating of nautical charts, as well as small scale topographic maps. A plotter for large scale high speed image generation from CCT was developed.

N75-33471*# Oregon State Univ., Corvallis.
THE COMPARATIVE EVALUATION OF ERTS-1 IMAGERY FOR RESOURCE INVENTORY IN LAND USE PLANNING Final Report, Jul. 1972 - Jan. 1974
Barry J. Schrumpf, Principal Investigator, G. H. Simonson, D. P. Paine, R. D. Lawrence, W. T. Pyott, J. H. Herzog, R. J. Murray, J. A. Norgren, J. A. Cornwell, and R. A. Rogers Oct. 1974 322 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21831)
(E75-10416; NASA-CR-143406) Avail: NTIS HC $9.25 CSCL 08B

The author has identified the following significant results. Multidiscipline team interpretation and mapping of resources for Crook County is complete on 1:250,000 scale enlargements of ERTS imagery and 1:120,000 hi-flight photography. Maps of geology, soils, vegetation-land use and land resources units were interpreted to show limitations, suitabilities, and geologic hazards for land use planning. Mapping of lineaments and structures from ERTS imagery has shown a number of features not previously mapped in Oregon. A multistage timber inventory of Ochoco National Forest was made, using ERTS images as the first stage. Inventory of forest clear-cutting practices was successfully demonstrated with color composites. Soil tonal differences in fallow fields correspond with major soil boundaries in loess-mantled terrain. A digital classification system used for discriminating natural vegetation and geologic material classes was successful in separating most major classes around Newberry Caldera, Mt. Washington, and Big Summit Prairie.

N75-33472*# Maine Dept. of Transportation, Augusta.
MULTIDISCIPLINARY ANALYSIS OF SKYLAB PHOTOGRAPHY FOR HIGHWAY ENGINEERING PURPOSES Final Report, Aug. 1973 - Feb. 1975
Ernest G. Stoeckeler, Raymond G. Woodman, Principal Investigators, and Robert S. Farrell 28 Feb. 1975 115 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13359)
(E75-10417; NASA-CR-141942) Avail: NTIS HC $5.25 CSCL 13B

The author has identified the following significant results. The greatly increased resolution of ground features by Skylab as compared with LANDSAT is considered to be best in the S190B high resolution film, followed by S190A camera stations 4, 5, and 6 respectfully. Results of the study of vegetation damage sites using data derived from S190A film were disappointing. The major cause of detection problems is the graininess of the CIR film. Good results were achieved for the hydrology-land use study. Both camera systems gave better agreement with the ground truth than did LANDSAT imagery. Surficial geology and glacial landform areas were clearly visible in single scenes. Several previously unmapped or unknown features were detected, especially in eastern coastal Maine.

N75-33473*# General Electric Co., Philadelphia, Pa. Space Div.
APPLICATION OF EARTH RESOURCES TECHNOLOGY SATELLITE DATA TO URBAN AND REGIONAL PLANNING: TEST SITE, COUNTY OF LOS ANGELES Final Report, 30 Jun. 1972 - 30 Jun. 1974
S. Raja, J. McKnight, G. Willoughby, and R. Economy, Principal Investigators 2 Dec. 1974 174 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21797)
(E75-10418; NASA-CR-143408; Doc-74SD4265) Avail: NTIS HC $6.25 CSCL 08B

The author has identified the following significant results. The County of Los Angeles photointerpreted ERTS film products to define problems of interest, coordinated ground truth over the complex test site including interfaces with secondary users as well as participated in on-line analyses of the GE multispectral information extraction systems. Interactive machine analyses were carried out, developing techniques and procedures as well as evaluating the outputs for community and regional planning. Extensive aircraft underflight coverage was provided that was valuable both in inputs preparation and outputs evaluation of the machine-aided analyses. One of the nonstandard ERTS images led to the discovery of a major new fault lineament on the northern slope of the Santa Monica Mountains.

N75-33474*# Earth Satellite Corp., Berkeley, Calif.
INVESTIGATION TO DEVELOP A MULTISTAGE FOREST SAMPLING INVENTORY SYSTEM USING ERTS-1 IMAGERY Final Report, Sep. 1972 - Feb. 1974
Philip G. Langley, Jan W. VanRoessel, Principal Investigators, and S. L. Wert Mar. 1975 136 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21853)
(E75-10419; NASA-CR-144307) Avail: NTIS HC $5.75 CSCL 02F

The author has identified the following significant results. The annotation system produced a RMSE of about 200 m ground distance in the MSS data system with the control data used. All the analytical MSS interpretation models tried were highly significant. However, the gains in forest sampling efficiency that can be achieved by using the models vary from zero to over 50 percent depending on the area to which they are applied and the sampling method used. Among the sampling methods tried, regression sampling yielded substantial and the most consistent gains. The single most significant variable in the interpretation model was the difference between bands 5 and 7. The contrast variable, computed by the Hadamard transform was significant but did not contribute much to the interpretation model. Forest areas containing very large timber volumes because of large tree sizes were not separable from areas of similar crown cover but containing smaller trees using ERTS image interpretation only. All correlations between space derived timber volume predictions and estimates obtained from aerial and ground sampling were relatively low but significant and stable. There was a much stronger relationship between variables derived from MSS and U2 data than between U2 and ground data.

N75-33475*# Bendix Corp., Ann Arbor, Mich.
APPLICATION OF LANDSAT TO THE SURVEILLANCE AND CONTROL OF LAKE EUTROPHICATION IN THE GREAT LAKES BASIN Progress Report, 11 May - 11 Aug. 1975
Robert H. Rogers, Principal Investigator Aug. 1975 45 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20942)
(E75-10420; NASA-CR-143409; BSR-4191; BSR-4192) Avail: NTIS HC $3.75 CSCL 08H

The author has identified the following significant results. By use of distilled water samples in the laboratory, and very clear lakes in the field, a technique was developed where the atmosphere and surface noise effects on LANDSAT signals from water bodies can be removed. The residual signal dependent only on the material in water was used as a basis for computer categorization of lakes by type and concentration of suspended material. Several hundred lakes in the Madison and Spooner, Wisconsin area were categorized by computer techniques for tannin or nontannin waters and for the degree of algae, silt, weeds, and bottom effects present. When the lakes are categorized as having living algae or weeds, their concentration is related to the enrichment or eutrophication of the lake.

N75-33476*# Battelle Columbus Labs., Ohio.
THE APPLICATION OF SKYLAB ALTIMETRY TO MARINE GEOID DETERMINATION Final Report
A. G. Mourad, S. Gopalapillai, M. Kuhner, and D. M. Fubara, Principal Investigators Jul. 1975 94 p refs EREP
(Contract NAS9-13276)
(E75-10421; NASA-CR-144372) Avail: NTIS HC $4.75 CSCL 08E

The author had identified the following significant results. The major results can be divided broadly into two groups. One group is concerned with the effects of errors inherent in the various input data, such as the orbit emphemeris, a priori geoid

etc. The other consists of the results of the actual analysis of the data from the Skylab EREP passes 4, 6, 7, and 9. Results from the first group were obtained from the analysis of some preliminary data from EREP pass 9 mode 5. The second group of results consists of a set of recovered bias terms for each of the submodes of observations and a set of nine altimetry geoid profiles corresponding to the various passes and modes. Along with each of these profiles, the a priori geoid, gravity anomaly, and the bathymetric data profiles are also presented for easy comparison.

N75-33477*# Federal Geological Survey, Hanover (West Germany).
HYDROGEOLOGICAL INVESTIGATIONS IN THE PAMPA OF ARGENTINA Final Report, Dec. 1973 - Nov. 1974
Dieter Bannert, Principal Investigators, H. Bender, W. Kruck, and J. J. Lago Nov. 1974 24 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E75-10422; NASA-CR-143410; Rept-1) Avail: NTIS HC $3.25 CSCL 08H

The author has identified the following significant results. Satellite imagery in combination with ground investigations allows identification and delineation of differences in the conditions of the near surface ground water (depth to ground water, salinity). The degree of precision achieved is greater than that obtainable by conventional ground survey methods alone.

N75-33478*# International Inst. for Aerial Survey and Earth Sciences, Enschede (Netherlands).
EVALUATION OF EREP TECHNIQUES FOR GEOLOGICAL MAPPING Final Report, Aug. 1974 - Aug. 1975
H. E. C. VanDerMeerMohr and G. S. Srivastava, Principal Investigators Aug. 1975 68 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(E75-10423; NASA-CR-143411) Avail: NTIS HC $4.25 CSCL 08B

The author has identified the following significant results. Skylab photographs may be successfully utilized for preparing a reconnaissance geological map in the areas where no maps or semi-detailed maps exist. Large coverage of area and regional perspective from Skylab photographs can help better coordination in regional mapping. It is possible to delineate major structural trends and other features like mega-lineaments, geofractures, and faults, which have evaded their detection by conventional methods. The photointerpretability is better in areas dominated by sedimentary rocks. Rock units of smaller extent and having poor geomorphic expressions are difficult to map. Demarcation of quaternary river alluvium can be made with better precision and ease with the Skylab photographs. Stereoscopic viewing greatly helps in interpretation of area structures. Skylab photographs are not good for preparing geological maps larger than 1:270,000 scale.

N75-33479*# Environmental Research and Technology, Inc., Concord, Mass.
STUDY TO DEVELOP IMPROVED SPACECRAFT SNOW SURVEY METHODS USING SKYLAB/EREP DATA Final Report, Mar. 1973 - May 1975
J. C. Barnes, Principal Investigator, M. D. Smallwood, and J. L. Cogan May 1975 96 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13305)
(E75-10424; NASA-CR-144388; ERT-0412-F) Avail: NTIS HC $4.75 CSCL 08L

The author has identified the following significant results. Of the four black and white S190A camera stations, snowcover is best defined in the two visible spectral bands, due in part to their better resolution. The overall extent of the snow can be mapped more precisely, and the snow within shadow areas is better defined in the visible bands. Of the two S190A color products, the aerial color photography is the better. Because of the contrast in color between snow and snow-free terrain and the better resolution, this product is concluded to be the best overall of the six camera stations for detecting and mapping snow. Overlapping frames permit stereo viewing, which aids in distinguishing clouds from the underlying snow. Because of the greater spatial resolution of the S190B earth terrain camera, areal snow extent can be mapped in greater detail than from the S190A photographs. The snow line elevation measured from the S190A and S190B photographs is reasonable compared to the meager ground truth data available.

N75-33480*# Applied Science Associates, Inc., Apex, N.C.
REDUCED BACKSCATTERING CROSS SECTION (SIGMA DEGREE) DATA FROM THE SKYLAB S-193 RADAR ALTIMETER Final Report, Sep. 1974 - Aug. 1975
G. S. Brown Oct. 1975 301 p refs
(Contract NAS6-2520)
(NASA-CR-141401) Avail: NTIS HC $9.25 CSCL 08J

Backscattering cross section per unit scattering area data, reduced from measurements made by the Skylab S-193 radar altimeter over the ocean surface are presented. Descriptions of the altimeter are given where applicable to the measurement process. Analytical solutions are obtained for the flat surface impulse response for the case of a nonsymmetrical antenna pattern. Formulations are developed for converting altimeter AGC outputs into values for the backscattering cross section. Reduced data are presented for Missions SL-2, 3 and 4 for all modes of the altimeter where sufficient calibration existed. The problem of interpreting land scatter data is also discussed. Finally, a comprehensive error analysis of the measurement is presented and worst case random and bias errors are estimated. Author

N75-33481*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GREAT LAKES ALL-WEATHER ICE INFORMATION SYSTEM
R. J. Schertler, R. A. Mueller, R. J. Jirberg, D. W. Cooper, J. E. Heighway, A. D. Holmes, R. T. Gedney, and H. Mark 1975 30 p refs Presented at 10th Intern. Symp. on Remote Sensing of the Environment, Ann Arbor, Mich., 6-10 Oct. 1975
(NASA-TM-X-71815) Avail: NTIS HC $3.75 CSCL 08L

A system is described which utilizes an X-band Side-Looking-Airborne-Radar (SLAR) for determining type, location, and aerial distribution of the ice cover in the Great Lakes and an airborne, S-band, short pulse radar for obtaining ice thickness. The SLAR system is currently mounted aboard a U.S. Coast Guard C-130B aircraft. Digitized SLAR data are relayed in real-time via the NOAA-GOES-1 satellite in geosynchronous orbit to the U.S. Coast Guard Ice Center in Cleveland, Ohio. SLAR images along with hand-drawn interpretative ice charts for various winter shipping areas in the Great Lakes are broadcast to facsimile recorders aboard Great Lakes vessels. The operational aspects of this ice information system are being demonstrated by NASA, U.S. Coast Guard, and NOAA/National Weather Service. Results from the 1974-75 winter season demonstrated the ability of this system to provide all-weather ice information to shippers in a timely manner. Author

N75-33482*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REMOTE PROFILING OF LAKE ICE USING AN S-BAND SHORT PULSE RADAR ABOARD AN ALL-TERRAIN VEHICLE
Dale W. Cooper, Robert A. Mueller, and Ronald J. Schertler 1975 19 p refs Presented at Subsurface Probing Session of the International Union of Radio Science Meeting, Boulder, Colorado, 20-23 Oct. 1975
(NASA-TM-X-71808; E-8502) Avail: NTIS HC $3.25 CSCL 08L

An airborne short-pulse radar system to measure ice thickness was designed. The system supported an effort to develop an all-weather Great Lakes Ice Information System to aid in extending the winter navigation season. Experimental studies into the accuracy and limitations of the system are described. A low power version was operated from an all-terrain vehicle on the Straits of Mackinac during March 1975. The vehicle allowed rapid surveying of large areas and eliminated the ambiguity in location between the radar system and the ground truth ice auger team. It was also possible to the effects of snow cover,

surface melt water, pressure ridging, and ice type upon the accuracy of the system. Over 25 sites were explored which had ice thicknesses from 29 to 60 cm. The maximum radar overestimate was 9.8 percent, while the maximum underestimate was 6.6 percent. The average error of the 25 measurements was 0.1 percent. Author

N75-33483*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

REMOTELY SENSING WHEAT MATURATION WITH RADAR

Thomas F. Bush and Fawwaz T. Ulaby May 1975 126 p refs

(Contract NAS9-10261)

(NASA-CR-144507; RSL-TR-177-55) Avail: NTIS HC $5.75 CSCL 02C

The scattering properties of wheat were studied in the 8-18 GHz band as a function of frequency, polarization, incidence angle, and crop maturity. Supporting ground truth was collected at the time of measurement. The data indicate that the radar backscattering coefficient is sensitive to both radar system parameters and crop characteristics particularly at incidence angles near nadir. Linear regression analyses of the radar backscattering coefficient on both time and plant moisture content result in rather good correlation. Furthermore, by calculating the average time rate of change of the radar backscattering coefficient it is found that it undergoes rapid variations shortly before and after the wheat is harvested. Both of these analyses suggest methods for estimating wheat maturity and for monitoring the progress of harvest. Author

N75-33484*# Texas Univ., Dallas.

STATISTICAL THEORY AND METHODOLOGY FOR REMOTE SENSING DATA ANALYSIS WITH SPECIAL EMPHASIS ON LACIE Annual Report, 1 Jun. 1974 - 31 May 1975

Patrick L. Odell Jun. 1975 219 p refs

(Contract NAS9-13512)

(NASA-CR-144509; JSC-09703) Avail: NTIS HC $7.25 CSCL 02C

Crop proportion estimators for determining crop acreage through the use of remote sensing were evaluated. Several studies of these estimators were conducted, including an empirical comparison of the different estimators (using actual data) and an empirical study of the sensitivity (robustness) of the class of mixture estimators. The effect of missing data upon crop classification procedures is discussed in detail including a simulation of the missing data effect. The final problem addressed is that of taking yield data (bushels per acre) gathered at several yield stations and extrapolating these values over some specified large region. Computer programs developed in support of some of these activities are described. Author

N75-33485*+ National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT: US STANDARD CATALOG NO. U-32

30 Apr. 1975 110 p

(NASA-TM-X-72890) Avail: NTIS HC $5.25; EROS Data Center, Sioux Falls, S. D., 57198 HC $1.25 CSCL 05B

For abstract, see N75-33444.

N75-33486*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT INVENTORY OF SURFACE-MINED AREAS USING EXTENDIBLE DIGITAL TECHNIQUES

Arthur T. Anderson, Dorothy T. Schultz (GE Co., Beltsville, Md.), and Ned Buchman Aug. 1975 23 p refs

(NASA-TM-X-70978; X-900-75-165) Avail: NTIS HC $3.25 CSCL 08I

Multispectral analysis of LANDSAT imagery provides a rapid and accurate means of identification, classification, and measurement of strip-mined surfaces in Western Maryland. Four band analysis allows distinction of a variety of strip-mine associated classes, but has limited extendibility. A method for surface area measurement of strip mines, which is both geographically and temporally extendible, was developed using band-ratioed LANDSAT reflectance data. The accuracy of area measurement by this method, averaged over three LANDSAT scenes taken between September 1972 and July 1974, is greater than 93%. Total affected acreage of large (50 hectare/120 acre) mines can be measured to within 1.0%. Author

N75-33487# Technische Universitaet, Munich (West Germany). Inst. for Astronomical and Physical Geodesy.

COMPARISON OF METHODS FOR ESTABLISHING LARGE SCALE GEODETIC NETWORKS BY MEANS OF SATELLITE TECHNIQUES

H. Ludwig Nov. 1974 14 p refs Presented at the Un Inter-Regional seminar on Appl. of Geodetic and Remote Sensing Data from Satellites for Cartography (Surveying and Mapping), Sao Jose dos Campos, Brazil, 4-15 Nov. 1974 Sponsored by Deut. Forschungsgemeinschaft

(Contrib-118) Avail: NTIS HC $3.25

Different methods for the determination of station coordinates from satellite observations were compared in regard to their accuracy and applicability to the establishment of geodetic networks. The results are clearly in favor of Doppler observations with a satellite service system like those provided by the Navy Navigation Satellite System (NNSS). Author (ESA)

N75-33488# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

USE OF SIDE LOOKING AIRBORNE RADAR TO DETERMINE LAKE DEPTH ON THE ALASKAN NORTH SLOPE

P. Sellmann, W. F. Weeks, and W. J. Campbell May 1975 14 p refs

(AD-A011249; CRREL-SR-230) Avail: NTIS CSCL 08/12

Side-looking airborne radar (SLAR) imagery obtained in April-May 1974 from the North Slope of Alaska between Barrow and Harrison Bay indicates that tundra lakes can be separated into two classes based on the strength of the radar returns. Correlations between the areal patterns of the returns, limited ground observations on lake depths, and information obtained from ERTS imagery strongly suggest that freshwater lakes giving weak returns are frozen completely to the bottom while lakes giving strong returns are not. Brackish lakes also give weak returns even when they are not completely frozen. This is presumably the result of the brine present in the lower portion of the ice cover limiting the penetration of the X-band radiation into the ice. Although the physical cause of the differences in radar backscatter has not been identified, several possibilities are discussed. The ability to rapidly and easily separate the tundra lakes into these two classes via SLAR should be useful in a wide variety of different problems. GRA

N75-33489# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.

MODELING AND CONTOURING IRREGULAR SURFACES SUBJECT TO CONSTRAINTS Final Report

James R. Jancaitis Jan. 1975 163 p refs

(Contract DAAK02-73-C-0213)

(AD-A010406; ESS-3325-101-75; ETL-CR-74-19) Avail: NTIS CSCL 08/2

The purpose of the work under this contract was the development of mathematical techniques and associated computer software for constraining mathematical models of topographic surfaces to agree with digitized stream, road, lake surface and boundary, and (automatically detected) peak data; so that computer generated contours extracted from these mathematical models would correctly reflect the presence of these features. This research and development effort has resulted in the following major accomplishments: The weighting function interpolation technique, WIT; interpolation and approximation theorems for WIT; sequential least squares techniques applied to control constraints; software for CONtouring via the Surface Averaging Concept, CONSAC; general purpose data editing software, GDES; analytic investigation of stream constraint; preliminary digital data analysis software, SIMCON and THREED; numerical investigation of the data compaction properties of WIT. GRA

N75-33490# Defence Research Establishment Ottawa (Ontario). Earth Sciences Div.

SOME SEA ICE OBSERVATIONS AT HERSCHEL ISLAND IN MID WINTER 1973

Gerald J. Irwin Jul. 1974 23 p refs

(AD-A010498; DREO-TN-74-16) Avail: NTIS CSCL 08/12

Some observations of sea ice near the shoreline were made

during a week's visit to Herschel Island, N.W.T. in January and February 1973. The observations of leads, hummocks, tidal cracks and ice strains constitute the author's initial acquaintance with ice conditions above the arctic circle. Apparent expansions and contractions in the level ice sheet of Thetis Bay give positive and negative values of strain averaging 0.00017. The latter phenomenon may correspond to relative decreases and increases in air temperature from day to day. GRA

N75-33491# Beychok (Milton R.), Irvine, Calif.
PROCESS AND ENVIRONMENTAL TECHNOLOGY FOR PRODUCING SNG AND LIQUID FUELS Environmental Protection Technology Series
Milton R. Beychok Mar. 1975 152 p
(Contract EPA-68-03-2136)
(PB-242774/8; EPA-660/2-75-011) Avail: NTIS HC $6.25; SOD HC as SN-055-001-01017 CSCL 07A

The process technology and environmental factors involved in the emerging industries for providing new supplemental energy supplies from nonconventional sources are discussed. It includes: (1) the production of substitute natural gas (SNG) from coal, crude oil and naphtha, (2) importing overseas gas supplies in the form of liquefied natural gas (LNG) and as liquid methanol, (3) the regasification of LNG, (4) the production of liquid fuels from oil shale, and (5) the liquefaction of coal to produce clean fuels. The technology of oil and gas processing, heat balances, fuel combustion and stack gases, thermal efficiencies, and water balances is assessed. GRA

N75-33492# California Univ., Davis. Water Resources Center.
EVALUATION OF A PROBABILITY APPROACH TO UNCERTAINTY IN BENEFIT-COST ANALYSIS Completion Report
Lloyd J. Mercer and W. Douglas Morgan Apr. 1975 66 p refs
(PB-242370/5; Contrib-149; W75-08478; OWRT-A-053-CAL(1)) Avail: NTIS HC $4.25 CSCL 13B

The application of the Weibull probability distribution to the problem of uncertainty in benefit-cost analysis was evaluated. Economy of information, versatility with regard to shape, ability to incorporate objective information, and ease of mathematical manipulation support the use of the distribution. Compared to range sensitivity tests, the only additional pieces of information required are the probabilities that the actual values of the variable will be less than the low or exceed the high of the range. The Weibull probability assignment technique was applied to four separate benefit-cost studies concerning water resources. The standard deviation and central tendency measures of the outcome distribution (net benefits, benefit-cost ratio, etc.) were determined, as well as the probability of an outcome indicating the project is not feasible. The results obtained indicate that the technique is a significant improvement over range sensitivity tests to resolve uncertainly in benefit-cost analysis. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N75-33493*# Gould, Inc., Mendota Heights, Minn.
FABRICATION AND TESTING OF NEGATIVE LIMITED SEALED NICKEL-CADMIUM CELLS Final Report, 1 Jul. 1974 - 28 Feb. 1975
D. J. Gordy 31 Mar. 1975 68 p refs
(Contracts NAS7-100; JPL-953680)
(NASA-CR-143628; Rept-752-015) Avail: NTIS HC $4.25 CSCL 10C

A number of 20 Ah and 3 Ah negative limited nickel-cadmium cells were fabricated and assembled in hermetically sealed stainless steel containers. The cells exhibit a large voltage rise signal, in excess of 250 mA, at the end of each charge period. They also exhibit lower self discharge rates than conventional sealed nickel-cadmium cells and do not require overcharge. The cells are capable of operating at charge and discharge rates up to 5C and can deliver at least 1000 cycles on a 30 minute regime at 25% DOD. A small amount of gassing occurs, but is not deemed critical or detrimental in view of the facts that, (1) operating pressures are in the range of 7 to 20 psig and (2) the cells are operated in the flooded condition so therefore contain little internal void volume. The cells were found to exhibit somewhat higher capacity loss rates during cycling than conventional sealed nickel-cadmium batteries. Author

N75-33494*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INCORPORATING ENERGY CONSERVATION TECHNIQUES IN THE OPERATION OF EXISTING LeRC R AND D FACILITIES
W. C. Nieberding 1975 20 p Presented at Annual NASA Facilities Conf., Pasadena, Calif., 21-24 Oct. 1975
(NASA-TM-X-71813) Avail: NTIS HC $3.25 CSCL 10B

A general discussion of various methods which can be used to reduce energy consumption is presented. A very brief description of Lewis Research Center facilities is given and the energy reduction methods are discussed relative to them. Some specific examples (ie; automated equipment and data systems) of the implementation of the energy reduction methods are included. Author

N75-33495# Committee on Science and Technology (U. S. House).
SOLAR HEATING AND COOLING DEMONSTRATION ACT OF 1974: OVERSIGHT HEARINGS
Washington NASA 1975 986 p refs Hearings before Subcomm. on Energy Res., Develop. and Demonstration of Comm. on Sci. and Technol., 94th Congr., 1st Sess., No. 13, 13-15 May 1975
(GPO-55-414) Avail: Subcomm. on Energy Res., Develop. and Demonstration

Oversight hearings made before the Subcommittee on Energy Research, Development and Demonstration of the Committee on Science and Technology of the U.S. House of Representatives on May 13-15, 1975 were described. These dealt with Public Law 93-409, the Solar Heating and Cooling Demonstration Act of 1974, and included discussions on the following subjects: solar heating, air conditioning, solar energy, electric power, energy consumption, energy costs, energy policy for Florida. Y.J.A.

N75-33496*# Energy Research Corp., Bethel, Conn.
DESIGN AND FABRICATION OF SILVER-HYDROGEN CELLS
M. G. Klein [1975] 71 p
(Contract NAS3-18543)
(NASA-CR-134878) Avail: NTIS HC $4.25 CSCL 10C

The design and fabrication of silver-hydrogen secondary cells capable of delivering higher energy densities than comparable nickel-cadmium and nickel-hydrogen cells and relatively high cycle life is presented. An experimental task utilizing single electrode pairs for the optimization of the individual electrode components, the preparation of a design for lightweight 20Ahr cells, and the fabrication of four 20Ahr cells in heavy wall test housing containing electrode stacks of the lightweight design are described. The design approach is based on the use of a single cylindrical self-contained cell with a stacked disc sequence of electrodes. The electrode stack design is based on the use of NASA-Astropower Separator Material, PPF fuel cell anodes, an intercell electrolyte reservoir concept and sintered silver electrodes. Results of performance tests are given. Author

N75-33497*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTROLYTE CONCENTRATION CHANGES DURING OPERATION OF THE NICKEL CADMIUM CELL
Gerald Halpert May 1975 13 p refs Submitted for publication

(NASA-TM-X-70977; X-711-75-135) Avail: NTIS HC $3.25 CSCL 10C

The concentration and distribution of aqueous potassium hydroxide (KOH) electrolyte in a sealed nickel cadmium cell is considered. The reactions at both electrodes during charge and discharge involve the production or utilization of hydroxyl ion (OH) or water (H2O) which directly affects concentration. Changes in electrolyte concentration relative to the individual electrode reactions is discussed. Quantitative values are provided for the changes in concentration for 6, 12, and 20 ah cells with accepted quantities of precharge and accepted initial quantity of 31% aqueous KOH. Consideration is given to a more correct equation which includes net changes in hydroxyl concentration in addition to water. Also, expected concentrations of electrolyte in cells in the fully charged, 75% charged, 50% charged, 25% charged and discharged condition are calculated. The expected concentration changes for cells in the accelerated tests are also tabulated and compared with measured values. All calculations are made on the assumption that there are no side reactions. Various properties which depend on KOH concentration are listed. The variables include O2, H2, and Cd(OH)2 solubilities in addition to viscosity and conductivity. Author

N75-33498# National Academy of Sciences - National Research Council, Washington, D.C.

SEMINAR ON INDUSTRIAL ENERGY CONSERVATION AND SEMINAR ON SOLAR SPACE HEATING AND COOLING Staff Summary Report

1975 28 p Seminar held at Seoul (Republic of Korea), 13-15 Nov. 1974; sponsored jointly by Rep. of Japan and Natl. Acad. of Sci. - Natl. Res. Council, Washington, D. C.

(Contract AID/CSD-2584)

(PB-241462/1) Avail: NTIS HC $3.75 CSCL 10A

The proceedings of two workshops on energy conservation and solar heating and heating are summarized. Topics discussed include: the technical and economic aspects of energy conservation, and application of industrial energy conservation techniques in terms of effectiveness, cost, and social acceptability. J.M.S.

N75-33499# Michigan Univ., Ann Arbor. Highway Safety Research Inst.

STUDY ON THE EFFECTS OF THE ENERGY CRISIS AND 55 MPH SPEED LIMIT IN MICHIGAN Final Report

James Oday, Daniel J. Minahan, and Dan Golomb Apr. 1975 61 p Prepared in cooperation with Mich. Office of Highway Safety Planning, Lansing

(PB-241843/2; UM-HSRI-SA-75-9) Avail: NTIS HC $4.25 CSCL 13L

The report is a presentation of the findings and conclusions derived from an analysis of Michigan traffic accident data and related data for the periods before, during, and after the peak energy crisis months of 1974. A major objective of this study was to identify the effect of the speed limits imposed as a result of the energy shortage. Some other causative factors relating to traffic crashes also were investigated. The report differs from others in that it seeks to define the cause-effect relationships specifically within Michigan, rather than nationally. Also by concentrating the study to a single state, it was possible to get more consistent data across several measures--exposure, accident data, speed data--resulting in a more detailed analysis. GRA

N75-33500# Virginia Energy Office, Richmond.

GLOSSARY OF ENERGY TERMINOLOGY

Kathy Erickson and Deborah Sherman Mar. 1975 119 p

(PB-242071/9; VEO-75-01) Avail: NTIS HC $5.25 CSCL 05B

The objective of the glossary is to provide the public with a publication for quick reference to terms, conversion tables, and abbreviations used every day in the energy field. GRA

N75-33501# Nuclear Regulatory Commission, Washington, D.C. Economic Analysis Section.

COORDINATION, COMPETITION, AND REGULATION IN THE ELECTRIC UTILITY INDUSTRY

Vid W. Penn, James B. Delaney, and T. Crawford Honeycutt Jun. 1975 55 p refs

(PB-242718/5; NUREG-75/061) Avail: NTIS HC $4.25 CSCL 05C

An investigation of the interrelated roles played by competition, coordination and regulation in the electric utility industry has been prepared by the Office of Antitrust and Indemnity of the Nuclear Regulatory Commission. The effect of coordinated planning and facilities on competition is contrasted with the effect on competition of the holding company or other forms of industry consolidation. Finally, the role of regulation, as it affects both coordination and competition, is discussed. The authors conclude that competition and coordination in the electric utility industry are compatible with one another, and that regulation should be aimed at encouraging opportunities for both. GRA

N75-33502# Massachusetts Univ., Amherst. Energy Alternatives Program.

HOT WATER HYDRAULICS OF THE GULF STREAM SITED OTGM

Daniel Seluk and Robert H. Kirchhoff Mar. 1975 77 p refs

(Grant NSF GI-34979)

(PB-242151/9; NSF/RANN/SE/GI-34979/TR/75/2; NSF/RA/N-75-027) Avail: NTIS HC $4.75 CSCL 10B

The results are presented of a study to determine if the kinetic energy of the Gulf Stream can be used as a pump for the evaporators in an ocean thermal energy system. The proposed evaporator is of the plate fin heat exchanger type but calculations for the staggered tube type boiler have also been developed. The flow field for both types of evaporators is assumed to be similar to that of a screen submerged in an infinite two dimensional potential flowfield. The problem is then reduced to determining the pressure loss coefficient for each arrangement. Momentum and thermal recovery in the wake of ocean pumped plants are investigated, and graphs are presented to allow the determination of downstream plant spacing. GRA

N75-33503# Dow Chemical Co., Freeport, Tex.

ENERGY CONSUMPTION: THE PRIMARY METALS AND PETROLEUM INDUSTRIES Final Report, Aug. 1974 - Mar. 1975

John T. Reding and Burchard P. Shepherd Apr. 1975 59 p refs

(Contract EPA-68-02-1329)

(PB-241990/1; EPA-650/2-75-032-B) Avail: NTIS HC $4.25 CSCL 10A

Results are reported of a study of energy consumption in the primary metals and petroleum industries. It analyzes energy-intensive steps or operations for commonly used manufacturing processes. Results of the analyses are in the form of energy consumption block diagrams, energy-intensive equipment schematic diagrams and tables that indicate the causes of energy losses, as well as possible conservation approaches. GRA

N75-33504# Stein (Richard G.) and Associates, New York.

RESEARCH DESIGN CONSTRUCTION AND EVALUATION OF A LOW ENERGY UTILIZATION SCHOOL, RESEARCH PHASE 1 Interim Report

Richard G. Stein and Carl Stein 15 Aug. 1974 297 p refs

(Grant NSF GI-39612)

(PB-242217/8; NSF/RA/N-74-117) Avail: NTIS HC $8.75 CSCL 10A

A re-examination of the education determinants that have influenced energy consumption in the past, is presented along with a review of the technical performance of building components. Results indicate that substantial energy savings can be achieved in schools. Since educational buildings represent 7% of the building area in total U.S. construction these savings are considerable. GRA

N75-33505# Mitre Corp., Bedford, Mass.

A SYSTEMS APPROACH TO INNOVATIVE SOLUTIONS TO THE ENERGY PROBLEM Final Report

Phillip R. Vance Dec. 1973 279 p refs

(Grant NSF DI-39519)

(PB-242189/9; NSF/RA/R-73-008; NSF/RD1-8) Avail: NTIS HC $8.75 CSCL 10A

The formation of an institutional mechanism is described whose objectives are to increase the level of non-federal support for energy related research and development, to stimulate the innovation process, and to facilitate the transition of research

and development products from laboratory to operational use. Research and development project activities undertaken in cooperation with research directors of the three largest electric utilities, public officials, and university experts in New England are described. The projects cover such topics as fossil fuel switching systems. Operational and pending agreements for cost-sharing by appropriate companies are cited, as are criteria for the measurement of the impact of the efforts undertaken in this experiment in cooperative research and development. GRA

N75-33506# Massachusetts Inst. of Tech., Cambridge. Energy Lab.

PROJECT INDEPENDENCE REPORT: A REVIEW OF US ENERGY NEEDS UP TO 1985

Jerry A. Hausman Apr. 1975 60 p refs

(PB-242142/8; MIT-EL-75-009) Avail: NTIS HC $4.25 CSCL 10A

A review and assessment of the Federal Energy Adminstration's Project Independence Report is undertaken. Special emphasis is placed in the energy mode and its forecast of U.S. energy needs up through 1985. Biases are pointed out and the uncertainty of the final result is emphasized. GRA

N75-33507# Stanford Research Inst., Menlo Park, Calif. Center for the Study of Social Policy.

PLAUSIBILITY OF A RESTRICTED ENERGY USE SCENARIO

Joe E. Armstrong and Willis W. Harman 8 Jan. 1975 211 p refs

(Contract C-5-35546)

(COM-75-10749/0; CSSP-3705-8) Avail: NTIS HC $7.25 CSCL 10A

The consequences are examined of high and modest scenario projections of energy usage in the United States with and without adoption of modest energy conservation measures. The objectives of the overall study are: (1) to establish the plausibility that for a variety of reasons the United States may choose or find itself forced to accept at some point in the future a low or even static growth in energy usage (2) to explore the validity of the use of past trends and inter-element relationships for the economic, social, and technical projections up to and beyond 1990; and (3) to assess the feasibility of key characteristics of a comprehensive energy conservation plan. GRA

N75-33508# Massachusetts Univ., Amherst.

AN ANALYSIS OF THE FLUID MOTION INTO THE CONDENSER INTAKE OF A 400 mW(e) OCEAN THERMAL DIFFERENCE POWER PLANT

Peter A. Mangarella Mar. 1975 27 p refs

(Grant NSF GI-34979)

(PB-242569/2; NSF/RANN/SE/GI-34979/TR/75/3; NSF/RA/N-75-029) Avail: NTIS HC $3.75 CSCL 10B

The report addresses the following questions regarding the operation of an intake device in a complex stratified flow typical of the Gulf Stream: (1) would flow into such an intake create disruption of the thermocline if placed in depths of the order of 300-800 meters thereby withdrawing warm surface waters which would adversely affect the condenser operation, (2) if a finite withdrawal layer is created by such a device, what is the size and configuration of the layer, (3) what is the effect of such a withdrawal layer on the average temperature of the water so withdrawn, and can this average temperature be predicted, and (4) what is the possibility of entraining botton deposits from such an intake device and can some criteria be developed for avoiding scouring. GRA

N75-33509# Hawaii Univ., Honolulu. Dept. of Ocean Engineering.

AN EVALUATION OF OCEANOGRAPHIC AND SOCIOECONOMIC ASPECTS OF A NEARSHORE OCEAN THERMAL ENERGY CONVERSION PILOT PLANT IN SUBTROPICAL HAWAIIAN WATERS Final Report, 1 May 1974 - 31 Jul. 1975

Karl H. Bathen 30 Apr. 1975 312 p refs

(Grant NSF AER74-17521-A01)

(PB-242167/5; NSF/RANN/SE/AER74-17521-A01/FR; NSF/RA/N-75-028) Avail: NTIS HC $9.25 CSCL 10B

Ocean thermal energy conversion (OTEG) proof-of-concept/pilot plant studies in subtropical waters are discussed. The three-part socio-economic program is concerned with examining the legal aspects of a nearshore OTEC plant. The applicable law, federal interests, licenses and permits, opposing interests, legislative experience and site considerations are considered. An attempt is made to characterize the existing socio-economic conditions in the Kona (Keahole) area by examining the social infrastructure, local population, labor force, income and education, Konal electrical demand, and potential impact of a new power source. An input-output analysis for the Kona area was completed to model and further predict the impact of a new energy source on the economy of Hawaii County. GRA

N75-33510# Energy Research Corp., Bethel, Conn.

FUEL CELL STACKS Semiannual Technical Report, 27 Jun. - 27 Dec. 1974

Apr. 1975 32 p

(Contract DAAK02-74-C-0367)

(AD-A009587; ERC-7396-S) Avail: NTIS CSCL 10/2

Processes for the manufacture of phosphoric acid fuel cell components are described. Electrodes, matrices and bipolar gas distribution plates for use in fuel cells with an active area of approximately 0.4 sq. ft. were fabricated. Samples from these components have been tested in fuel cells and all items have demonstrated life in excess of 1000 hours. Perfofmance data are given. GRA

N75-33511# Massachusetts Inst. of Tech., Cambridge. Energy Lab.

THE FUTURE OF THE US NUCLEAR ENERGY INDUSTRY

Paul L. Joskow and Martin L. Baughman Apr. 1975 59 p refs

(Grant NSF SIA-73-07871-A02)

(PB-242164/2; MIT-EL-75-006; NSF/RA/N-75-033) Avail: NTIS HC $4.25 CSCL 18E

A regional supply-demand-regulatory model of the U.S. electric utility industry is used to evaluate the derived demand for commercial nuclear reactors, raw uranium, and enrichment requirements for the period 1975-1995. The structure of the domestic nuclear energy industry is outlined and the engineering-econometric supply-demand system used for the analyses is described. Conclusions of analysis for alternative assumptions about air quality regulations, peak-load pricing, costs of uranium resources, and future costs of capital to the electric utility industry are included. GRA

N75-33512# Defence Research Establishment Ottawa (Ontario).

STUDIES RELATED TO THE LOW TEMPERATURE RECHARGE OF THE LEAD-ACID SYSTEM

Christopher L. Gardner and Francois Rocheleau Jan. 1975 24 p refs

(AD-A011027; DREO-TN-75-1) Avail: NTIS CSCL 07/4

A study has been made of the effects of temperature and sulphuric acid concentration on the formation of persulphuric acid at a lead dioxide electrode and also the recharge properties of the electrode. The effect of electrolyte pH has also been examined. Based on these results some conclusions have been drawn as to the nature of the low temperature recharge problem of the lead-acid battery. GRA

N75-33513# Massachusetts Inst. of Tech., Cambridge. Energy Lab.

INTERFUEL SUBSTITUTION IN THE CONSUMPTION OF ENERGY IN THE UNITED STATES. PART 2: INDUSTRIAL SECTOR

Martin L. Baughman and Frederick S. Zerhoot 25 Apr. 1975 54 p refs

(Grant NSF SIA-73-07871)

(PB-242230/1; MIT-EL-75-007-Pt-2; NSF/RA/N-75-034) Avail: NTIS HC $4.25 CSCL 21D

Specified and estimated are a set of derived demand functions for energy in the industrial sector of the United States. A three level model is used, consisting of: (1) an equation relating aggregate United States energy consumption in the industrial sector to value-added in manufacturing and average energy prices; (2) a set of equations interrelation geographical patterns of energy consumption by state to cross-sectional energy costs; and (3) a set of fuel split relationships that interrelate the fuel consump-

tion configuration (coal, natural gas, oil, and electricity) to relative prices of the alternative energy forms. The model is dynamically specified and estimated with data for a time-series of cross-section for the U.S. GRA

N75-33514# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
ELECTRIC UTILITY FUEL CHOICE BEHAVIOR IN THE UNITED STATES
Paul L. Joskow and Frederick S. Mishkin Oct. 1974 40 p refs
(Grant NSF SIA-73-07871)
(PB-242229/3; MIT-EL-74-015; NSF/RA/N-74-202) Avail: NTIS HC $3.75 CSCL 21D

The specification and estimation of a set of fuel choice relationships are reported for fossil fuel base load steam-electric plant. The fuel choice decision is analyzed to explicitly take account of the discreteness of fuelburning techniques available to the firm. For this purpose a probability model of the conditional logit form is used. The relationships were estimated using maximum likelihood techniques. GRA

N75-33515# RAND Corp., Santa Monica, Calif.
DIRECT AND INDIRECT ENERGY DEMAND MODELS FOR DoD
C. C. Mow Jun. 1974 32 p refs Presented at 33d Military Operations Res. Symp. (MORS), West Point, New York, 25-27 Jun. 1974
(AD-A010968; P-5273) Avail: NTIS

To properly assess the impact of the energy shortage on national security, it is essential to have an insight into how energy is used in support of the military. This report presents some of the results of the energy demand models currently being developed under ARPA sponsorship. Two energy models are described: (1) Direct energy model: A USAF Energy Consumption Projection Model; (2) Indirect energy demand model: Energy Consumption by Industries in Support of National Defense. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N75-33516 Colorado State Univ., Fort Collins.
EXTRACTION OF INFORMATION ON INORGANIC WATER QUALITY Ph.D. Thesis
William Lewis Lane 1975 223 p
Avail: Univ. Microfilms Order No. 75-21246

The potential for obtaining information concerning certain water quality variables on a stream by considering the relationships which exist between quality and quantity variables is examined. More precisely, the study is concerned with the relationship which exists between discharge and inorganic water quality in natural streams. Inorganic water quality is taken to refer to the concentrations of inorganic constituents found dissolved in the stream water. Natural streams are defined as those streams which are free of man's influence. The relationship studied is the negative correlation between inorganic water quality and discharge which is found in virtually all streams. Study is limited to thirteen inorganic constituents: SiO2, Fe, Ca, Mg, Na, K, HCO3, SO4, Cl, F, NO3, B, and pH (minus the logarithm of the H ion activity). In addition, conductivity is taken as an indicator of the total inorganic dissolved solids concentration. Dissert. Abstr.

N75-33517 California Univ., Los Angeles.
A COMPUTATIONAL STUDY OF THE TRANSPORT OF AIR POLLUTANTS IN A MIXING LAYER Ph.D. Thesis
William Rex Goodin 1975 126 p
Avail: Univ. Microfilms Order No. 75-21654

A pollutant transport model employing the shallow-water approximation was presented. The results of a simulation using carbon monoxide data from Los Angeles demonstrate that this technique can produce realistic results while achieving a large reduction in computer time and storage due to the two-dimensional formulation. A divergence-free wind field with the velocities at measuring stations left unchanged is also displayed for use in the pollutant transport model. A second, more innovative technique for producing a wind field is also demonstrated. This involves dynamic calculation of the wind from a heat balance at the earth's surface. The results of this simulation are qualitatively accurate. A number of advection schemes are compared using an idealized example. It is found that some schemes perform better than others when the quantity transported contains short wavelength components, as does a mesoscale pollutant distribution. Dissert. Abstr.

N75-33518 Arizona State Univ., Tempe.
EMISSIONS TAXATION AS A TOOL FOR CONTROLLING ENVIRONMENTAL QUALITY: SOME THEORETICAL PROBLEMS Ph.D. Thesis
Richard Loren Doege 1975 115 p
Avail: Univ. Microfilms Order No. 75-22832

Emission taxes have been presented as an alternative policy for controlling environmental quality, and the pricing and standards approach was analyzed as a method for determining emission tax rates. It was found that this approach does not assure achievement of any predetermined environmental standard. Three aspects were examined. First, firms face a finite set of production process alternatives for controlling emission; when this condition exists, achievement of a preset environmental standard is not assured. Second, emission taxes do not assure a given environmental quality standard in the context of a general economic growth unless tax rates are constantly revised upward, and progressive taxation is problematical. Third, study of the iterative process which comprises the pricing and standards approach shows that convergence on the target standard may be impeded by firms responding to expected rather than actual tax rates. Dissert. Abstr.

N75-33519 Louisiana State Univ. and A&M Coll., Baton Rouge.
A PERMEATION METHOD FOR THE DETERMINATION OF CARBON MONOXIDE IN THE AMBIENT ATMOSPHERE
David Robert Bell 1975 62 p
Avail: Univ. Microfilms Order No. 75-22194

A permeation method, employing a silver sol colorimetric reagent, for determining CO concentration in the ambient atmosphere is reported. In the procedure a small quantity of the colorimetric reagent is placed in a glass tube covered on the bottom with a silicone rubber membrane and stoppered at the top. This permeation device is exposed to the ambient atmosphere. As air passes over the membrane, carbon monoxide in the air permeates through the membrane and reacts with the reagent, producing a yellow silver sol. At the end of the exposure period the device is returned to the laboratory, and the intensity of the yellow color is used as a measure of the carbon monoxide concentration in the air. The method is a simple, inexpensive and reliable method for the determination of average concentrations of carbon monoxide from 2 to 80 ppm during exposure periods of 2 to 24 hours. The method requires no electrical or mechanical connections to complex equipment, and no tedious sampling technique is required. Dissert. Abstr.

N75-33520 Oklahoma Univ., Norman.
EVALUATION OF AMBIENT AIR BORNE PARTICULATES IN AN INDUSTRIAL ENVIRONMENT Ph.D. Thesis
Keith Lane Stanley 1975 109 p
Avail: Univ. Microfilms Order No. 75-21828

The multiple simultaneous collection and subsequent gravimetric determination of suspended particulate mass is discussed for particulate laiden ambient air at an Oklahoma City industrial site. The data reveal the differences of suspended particulate mass as collected by diverse sampling equipment. Analyses of airborne particulates at the industrial site included determination of mass concentrations of suspended particulates, and transmittance qualities of suspended particulates. Size distribution of suspended particulate mass in ambient air was determined by use of an Anderson Head adapter and a fractionation sampler. The cumulative mass, 1 micron or less, comprised 50 to 70 percent of the total mass of suspended particulates collected. Significant linear relationships were established between a standard high volume sampler, the Anderson Head adapter and

the fractionation sampler for total suspended particulates mass over the range of data collected. Dissert. Abstr.

N75-33521# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
PROCEEDINGS OF THE 5TH ANNUAL CONFERENCE ON ENVIRONMENTAL TOXICOLOGY Final Report
Dec. 1974 480 p refs Conf. held at Fairborn, Ohio, 24-26 Sep. 1974
(AF Proj. 6302)
(AD-A011563; AMRL-TR-74-125) Avail: NTIS CSCL 06/20
The major technical areas discussed included ecosystem modeling, water pollution, water reuse, toxic hazards evaluation of fire extinguishants, environmental carcinogenesis, and cellular toxicology. GRA

N75-33522# National Academy of Sciences - National Research Council, Washington, D.C. Committee on Motor Vehicle Emissions.
CONSULTANT REPORT ON FIELD PERFORMANCE OF EMISSIONS-CONTROLLED AUTOMOBILES
R. Robert Brattain, Jack L. Gockel, and D. James McDowell Nov. 1974 86 p refs
(Contract EPA-68-01-0402)
(PB-242091/7) Avail: NTIS HC $4.75 CSCL 13F
An evaluation was made of the feasibility of maintaining the automotive emissions control systems and engines which will be manufactured to meet various exhaust-emissions standards for oxides of nitrogen, hydrocarbons, and carbon monoxide so that these systems and engines will meet the standards in actual use. The present condition of the service industry, progress toward enforcing proper maintenance, and the impact of political actions and social attitudes on progress are discussed. GRA

N75-33523# Navy Dept., Washington, D.C.
ENVIRONMENTAL IMPACT STATEMENT. VOLUME 1: NAVAL OCEANOGRAPHIC CENTER, BAY ST. LOUIS, MISSISSIPPI Final Report
Jun. 1975 121 p refs
(AD-A010535) Avail: NTIS CSCL 13/2
The proposed action would establish a Naval Oceanographic Center at the National Space Technology Laboratory (NSTL), Bay St. Louis, Mississippi. A number of sites were visited and considered for the proposed action and analyses were made for the more competitive ones. No significant impact on the natural environment will result directly from the proposed action since existing facilities will fulfill most needs. Relocation of the affected activities could result in severance of certain family, cultural and community ties for many of the employees. Urbanization of the Countryside adjacent to several of the local communities will be speeded with the influx of new families and the attendant increase in demand for housing, municiple services and recreational facilities. GRA

N75-33524# Navy Dept., Washington, D.C.
ENVIRONMENTAL IMPACT STATEMENT. VOLUME 2: NAVAL OCEANOGRAPHIC CENTER, BAY ST. LOUIS, MISSISSIPPI Final Report
Jun. 1975 174 p
(AD-A010536) Avail: NTIS CSCL 13/2
Contents: Decentralization of DOD activities from NCR; Naval Oceanographic Office space requirements; Components and mission statements of agencies in residence in NSTL; Personnel plan; Mississippi Gulf Coast Region resources; Employment goals for Picayune/Pearl River County -- Mississippi; and Demographic data. GRA

N75-33525# Navy Dept., Washington, D.C.
ENVIRONMENTAL IMPACT STATEMENT. VOLUME 3. NAVAL OCEANOGRAPHIC CENTER, BAY ST. LOUIS, MISSISSIPPI. PUBLIC HEARING AND COMMENTS CONCERNING DRAFT OF DEPARTMENT OF THE NAVY ENVIRONMENTAL IMPACT STATEMENT ON PROPOSED RELOCATION OF NAVAL OCEANOGRAPHIC CENTER TO BAY ST. LOUIS, MISSISSIPPI Final Report
Jun. 1975 397 p
(AD-A010537) Avail: NTIS CSCL 13/2
Testimony is presented concerning the relocation of Naval Oceanographic Center to Bay St. Louis, Mississippi. The economic, social, and environmental impact of the move as it affects the Washington Metropolitan Area as well as Bay St. Louis is considered in detail. J.M.S.

N75-33526# National Environmental Research Center, Research Triangle Park, N.C. Control Systems Lab.
PROCEEDINGS: SYMPOSIUM ON FLUE GAS DESULFURIZATION, VOLUME 2
Dec. 1974 511 p refs Proc. held in Atlanta, Nov. 1974
(PB-242573/4; EPA-650/2-74-126-b-Vol-2) Avail: NTIS HC $12.25; HC also available $26.00/set of 2 reports as PB-242571-SET CSCL 07A
The proceedings document the presentations made during the symposium, which dealt with the status of flue gas desulfurization technology, both in the U.S. and abroad. The presentations emphasize process costs, both regenerable and non-regenerable processes second generation processes, and byproduct disposal/utilization. The aim of the symposium was to provide potential users of sulfur oxide control technology with a current review of progress made in applying processes for the reduction of sulfur oxide emissions at the full-or semi-commerical scale. Volume 2 covers regenerable processes, desulfurization by-product disposal and utilization, and second generation processes. GRA

N75-33527# Meloy Labs., Inc., Springfield, Va.
AIR POLLUTION EXPOSURE AND IMMUNOGLOBULIN LEVELS
Mar. 1974 20 p refs
(Contract EPA-68-02-0586)
(PB-242138/6; EPA-650/1-75-005) Avail: NTIS HC $3.25 CSCL 06E
The objective of the study was to determine whether air pollution affects serum levels of immunoglobulins to a different degree in smokers than in nonsmokers. The sera tested were obtained from army recruits in the Chicago area, 517 smokers and 147 nonsmokers. The smokers and nonsmokers were further categorized by geographic location and by the presence of cough and phlegm. The results indicated that no significant differences existed between the mean concentrations of immunoglobulins when smokers were compared to nonsmokers by geographic location, nor were there significant differences between smokers with cough and phelgm and those without. GRA

N75-33528# Marconsult, Inc., Santa Monica, Calif.
DEVELOPMENT OF BOAT AND HELICOPTER DEPLOYABLE OIL SLICK SAMPLER Final Report, Jun. - Aug. 1972
Alan A. Allen and Leland E. Fausak May 1975 54 p
(Contract DOT-CG-24828)
(AD-A010199; USCG-D-99-75) Avail: NTIS CSCL 13/2
MARCONSULT, Inc., has developed a device for the sampling of water-borne oil films ranging from 0.001 to 10 mm in thickness. The prototype device is a modified stainless steel testing sieve, normally used in sediment size analysis, into which is placed a sheet of sorbent material. The sampler is suspended from a cable or chain harness and is dipped into an oil slick; the oil film adheres to the stainless steel sieve screen and is absorbed by the sorbent sheet. After retrieval, the sampler is immediately sealed with a clean lid and bottom pan to prevent contamination of the oil sample, and thereby also becomes its own sample container. The results of a limited testing program indicate that the device will collect in excess of the required 50 ml of oil from fresh, thick films, but that samples of five to ten milliliters are more typical of very thin or weathered oil films. GRA

N75-33529# Coordinating Research Council, Inc., New York. Air Pollution Research Advisory Committee.
COOPERATIVE EVALUATION OF TECHNIQUES FOR MEASURING NITRIC OXIDE AND CARBON MONOXIDE IN DIESEL EXHAUST. PHASE 4 TEST REPORTS
Joseph Perez Jan. 1975 66 p refs
(PB-241710/3; CRC-472; CRC-APRAC-CAPI-1-65-8) Avail: NTIS HC $4.25 CSCL 14B
The measurements used to analyze diesel exhaust gas constituents are evaluated. A multi-cylinder engine was circulated to fifteen participants who measured emissions at three engine conditions. All fifteen participants measured nitric oxide and carbon

monoxide with several laboratories measuring nitric oxide by both nondispersive infrared spectroscopy and chemiluminescence. Some participants also measured carbon dioxide, nitrogen oxide, and oxygen and unknown span gases. These test results were compared with cooperative tests which involved simultaneous measurement of emissions by participants. GRA

N75-33530# North Carolina Agricultural and Technical State Univ., Greensboro.
EFFECTS OF AIR POLLUTANTS ON TEXTILE FIBER AND DYES Final Report
James B. Upham and Victor S. Salvin Feb. 1975 88 p refs
(Contract PH-22-68-2)
(PB-241507/3; EPA-650/3-74-008) Avail: NTIS HC $4.75 CSCL 13B

A comprehensive survey of the damaging effects of air pollutants - particulates, SOx, NOx, and ozone - on textile fibers and dyes is presented along with the results and assessment of a public opinion survey to primarily measure consumer awareness of the detrimental effects of air pollution on household textile products. Nearly 100 references are cited and many of the research investigations are detailed and discussed. The survey found that air pollution represents a significant problem area for the textile industry and many consumers. The public opinion survey revealed that consumer awareness of the major air pollution effects on household textile products is poorly established and generally lacking. GRA

N75-33531# Baird-Atomic, Inc., Bedford, Mass. Government Systems Div.
A SHIPBOARD OIL IN WATER CONTENT MONITOR BASED ON OIL FLUORESCENCE Final Report
A. W. Hornig and J. T. Brownrigg Feb. 1975 180 p refs
(Contract DOT-CG-34169)
(AD-A010475; USCG-D-87-75) Avail: NTIS CSCL 07/4

The purpose of this effort was to demonstrate the feasibility of a shipboard oil monitor based on the luminescence of oils emulsified in water. Luminescence characteristics of thirty non-Navy and eleven Navy oils and oil mixtures were documented as the basis of design for an instrument which performs a weighted sum of emission at several wavelengths (when excited at several wavelengths). Effects of salinity, temperature, pH, particulates, detergents, and energy transfer between oils were demonstrated. The breadboard demonstrated linearity with concentration of better than -5% from 10-100 ppm. While feasibility has been documented, several areas of improvement are suggested, including better emulsification, improved optical mask design, a transmission monitor and a high-level bypass monitor. GRA

N75-33532# Air Products and Chemicals, Inc., Marcus Hook, Pa. Houdry Div.
ENGINEERING AND COST STUDY OF AIR POLLUTION CONTROL FOR THE PETROCHEMICAL INDUSTRY. VOLUME 5: FORMALDEHYDE MANUFACTURE WITH THE MIXED OXIDE CATALYST PROCESS Final Report
R. B. Morris, F. B. Higgins, Jr., L. A. Lee, R. Newirth, and J. W. Pervier Mar. 1975 82 p refs
(Contract EPA-68-02-0255)
(PB-242547/8; EPA-450/3-73-006-e-Vol-5) Avail: NTIS HC $4.75 CSCL 07A

This document is one of a series prepared for the Environmental Protection Agency (EPA) to assist it in determining those petrochemical processes for which standards should be promulgated. The manufacture of formaldehyde with the mixed oxide catalyst process is covered. A process and industry description, an engineering description of available emission control systems, the cost of these systems, and the financial impact of emission control on the industry are included. Also presented are suggested air episode procedures and plant inspection procedures. GRA

N75-33533# Maryland Environmental Service, Annapolis, Md.
PRELIMINARY DESIGN OF A COMPREHENSIVE WASTE OIL PROCESSING FACILITY Final Report
Garth D. Gumtz and Edward J. Martin May 1975 142 p
Prepared in cooperation with Environ. Quality Systems, Inc.
(Grant EPA-S-800650)
(PB-242461/2; EPA-670/2-75-056) Avail: NTIS HC $5.75 CSCL 07A

A preliminary design is presented for a comprehensive waste oil recovery and disposal facility for the State of Maryland. The base for this design was an annual state-wide waste oil generation of 22,000,000 gallons which includes all known waste oil sources. With a 90 percent stream factor, feed to the plant is 66,000 gallons per day. GRA

N75-33534# Little (Arthur D.), Inc., Cambridge, Mass.
LITERATURE STUDY OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS, TITANIUM DIOXIDE Final Report
May 1975 131 p refs
(Contract EPA-68-01-2688)
(PB-242293/9; ADL-C-77354; EPA-560/2-75-001) Avail: NTIS HC $5.75 CSCL 06T

A comprehensive review of the literature published since 1 January 1954 was conducted on the physical and chemical properties of titanium dioxide (TiO2), on the environmental exposure factors related to its consumption and use, on the health and environmental effects resulting from exposure to TiO2, and on the regulations and standards governing its use. Current problems include concern about the future availability of rutile ore to supply the increasing number of facilities using this ore in the chloride manufacturing process, and the disposal of the high volume of TiO2 manufacturing wastes, particularly the spent sulfuric acid and ferrous sulfate from the sulfate manufacturing process. On the basis of reported information, TiO2 does not pose substantial environmental hazard. GRA

N75-33535# Houston Univ., Tex.
AN INTEGRATED POWER PROCESS MODEL OF WATER USE AND WASTEWATER TREATMENT IN CHLORINE CAUSTIC PRODUCTION
F. D. Singleton, Jr., James A. Calloway, and Russell G. Thompson 1975 92 p refs
(Grant NSF GI-34459)
(PB-242159/2; NSF/RA/E-74-048) Avail: NTIS HC $4.75 CSCL 07A

An economic evaluation was made of the effects of increasingly restrictive wastewater effluent standards and higher costs of water withdrawals on resource use, waste discharges, and costs of producing chlorine caustic. Both mercury cell and diaphragm cell methods of production were studied for large modern plants at the design stage. Zero discharges of total solids in mercury cell plants increased production costs 12.1%. Zero discharge restrictions of mercury may only be accomplished by use of diaphragm cells. GRA

N75-33536# National Environmental Research Center, Research Triangle Park, N.C. Quality Assurance and Environmental Monitoring Lab.
EVALUATION OF EFFECTS OF NO, CO2, AND SAMPLING FLOW RATE ON ARSENITE PROCEDURE FOR MEASUREMENT OF NO2 IN AMBIENT AIR Final Report
M. E. Beard, J. Suggs, and J. H. Margeson Apr. 1975 32 p refs
(PB-242285/5; EPA-650/4-75-019) Avail: NTIS HC $3.75 CSCL 07D

The arsenite method for measurement of NO2 in ambient air was investigated to quantify the effect of sampling flow rate and NO and CO2 concentration on method response. NO and CO2 were previously identified as positive and negative interferents in the method. Flow rates of 220 to 270 cc/min had no effect on the method response; higher flow rates decreased the method response. Atmospheres containing NO2, CO2, and NO were sampled with the arsenite method in a 3x3x3 factorial experiment with five observations per cell. The concentrations were NO2--50, 150, and 250 micrograms/cu m; NO--50, 180, and 310 micrograms/cu m; CO2--200, 350, and 500 ppm. GRA

N75-33537# National Environmental Research Center, Research Triangle Park, N.C. Quality Assurance and Environmental Monitoring Lab.
EVALUATION OF GAS PHASE TITRATION TECHNIQUES AS USED FOR CALIBRATION OF NITROGEN DIOXIDE CHEMILUMINESCENCE ANALYZERS Final Report
E. Carol Ellis and John H. Margeson Apr. 1975 49 p refs
(PB-242294/7; EPA-650/4-75-021) Avail: NTIS HC $3.75 CSCL 07D

A chemilluminescence procedure for the continuous measurement of nitrogen dioxide in ambient air is developed. Atmospheric concentrations of NO2 are measured indirectly by the chemiluminescence reaction of nitric oxide (NO) with ozone (O3). In the chemiluminescence procedure, an NO2 analyzer is calibrated by the gas phase titration of NO with O3 that produces NO2 stoichiometrically. GRA

N75-33538# GEOMET, Inc., Rockville, Md.
IMPROVEMENT OF INSTRUMENTATION AND METHODOLOGY FOR COLLECTION AND ANALYSIS OF MERCURY Final Report, Apr. - Sep. 1974
D. J. Sibbett, R. H. Moyer, and T. R. Quinn -Jan. 1975 84 p refs
(Contract EPA-68-02-1282)
(PB-242295/4; GEOMET-LF-434; EPA-650/2-75-028) Avail: NTIS HC $4.75 CSCL 07D

A collection device for the sampling of atmospheric mercury in its three forms, was miniaturized and streamlined and methods for the recovery and analysis of the collected mercury were simplified. The device consists of a two-section canister assembly which fits inside a standard Hi-Vol sampler underneath the support screen for the particulate filter. While particulate mercury is collected in the usual manner on glass fiber filter, mercury vapors are trapped on specific absorbants. Procedures were developed and tested for the recovery and analysis of elemental mercury, dimethyl mercury, and mercury-bearing particulates. These methods use standard laboratory instrumentation including an induction combustion furnace and an atomic absorption spectrophotometer. GRA

N75-33539# Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
EFFECT OF ATMOSPHERIC STABILITY AND WIND DIRECTION ON WATER TEMPERATURE PREDICTIONS FOR A THERMALLY-LOADED STREAM
David R. DeWalle Jan. 1975 36 p refs
(Contract DI-14-31-0001-9032)
(PB-242531/2; W75-08576; OWRT-C-4199(9032)(1)) Avail: NTIS HC $3.75 CSCL 13B

A steady-state, one-dimensional equation was used to predict water temperatures in the West Branch Susquehanna River at a point 5.4-km downstream from a thermal discharge for 131 time intervals. Two methods were employed to integrate the equation to predict downstream water temperature: (1) direct integration assuming a constant water surface heat exchange rate calculated from upstream water temperature and (2) numerical integration with the heat exchange rate varying with temperature. The direct integration method produced overestimates of heat loss and consequently underestimates of downstream water temperatures. GRA

N75-33540# Swedish Council for Building Research, Stockholm.
RESEARCH ON MAN AND HIS ENVIRONMENT; PROBLEMS DISCUSSION
1975 80 p
(PB-242451/3; ISBN-91-540-2343-2; Programme-19b) Avail: NTIS HC $4.75 CSCL 13M

The field of environmental research is analyzed from the points of view of content and organization. It is suggested that the effort be devoted to problem areas which are essential to planning, production, and construction in the light of the needs, requirements, and preferences of users. GRA

N75-33541# Gulf South Research Inst., Baton Rouge, La.
STATE USE OF FEDERAL TECHNICAL RESOURCES. REPORT OF A STUDY OF FEDERAL RESOURCES, MECHANISMS, AND BARRIERS REGARDING PROVIDING TECHNICAL ASSISTANCE TO THE STATES OF LOUISIANA AND MISSISSIPPI
Jackson M. Balch, Roger D. Rowland, and Kenneth C. Wagner 5 Apr. 1974 88 p Prepared in cooperation with Mississippi Res. and Develop. Center Sponsored by NSF
(PB-242460/4; NSF/RA/R-74-043) Avail: NTIS HC $4.75 CSCL 13B

Results are given of a study undertaken to determine if, from the states' point of view, there exists a need to establish a mechanism that would enable the states to take advantage of technology existing within the Federal structure. Ways in which existing Federal technology and technical assistance capabilities might be brought to bear on state problems, on terms acceptable to the states are identified. Interviews were held with key individuals in the major agencies of the states of Louisiana and Mississippi, and two workshops were conducted to provide a forum for participants from both the states and the Federal Government to mutually seek innovative improvements in the technology transfer process. GRA

N75-33542# National Academy of Sciences - National Research Council, Washington, D.C. Committee on Motor Vehicle Emissions.
CONSULTANT REPORT ON EMISSIONS AND FUEL ECONOMY TEST METHODS AND PROCEDURES
Richard A. Matula Sep. 1974 163 p refs
(Contract EPA-68-01-0402)
(PB-242093/3) Avail: NTIS HC $6.25 CSCL 13F

An assessment is made of the reliability and reproducibility of the test methods and procedures for automotive emissions and fuel economy measurements. The effect of ambient temperature on exhaust emissions, emissions control durability, test methods, measuring techniques for only reactive hydrocarbons emissions, and evaporative hydrocarbon emissions test methods are discussed. GRA

N75-33543# Aerospace Corp., El Segundo, Calif.
MEDIUM DUTY VEHICLE EMISSION CONTROL COST EFFECTIVENESS COMPARISONS. VOLUME 2: TECHNICAL DISCUSSION Urban Programs Div.
M. G. Hinton, J. Meltzer, T. Lura, J. A. Drake, and L. Forrest Jan. 1974 237 p refs
(Contract EPA-68-01-0417)
(PB-242247/5; ATR-74(7327)-1-Vol-2; EPA-460/3-74-004-b) Avail: NTIS HC $7.50 HC also available from NTIS $11.00/set of 2 reports as PB-242245-SET CSCL 13B

Light-duty vehicles (LDV) and medium-duty vehicles (MDV) selected to form the basis of cost factor comparisons are characterized and delineated. The specific emission control systems used in LDV and MDV cost calculations, the characteristics or baseline emission levels prior to incorporation of emission control systems, and the lifetime costs attributable to emission control are considered. A summary overview of emission control cost factors associated with power plants and other stationary sources is given. A review of numerous transportation planning studies for selected air quality control regions with emphasis on vehicle class distribution and annual mileage contributions is presented. GRA

N75-33544# Argonne National Lab., Ill. Energy and Environmental Systems Div.
AN EVALUATION OF STRATEGIES FOR AIRPORT AIR POLLUTION CONTROL Final Report
R. R. Cirillo, J. F. Tschanz, and J. E. Camaioni Jan. 1975 182 p refs Sponsored by EPA
(PB-242289/7; EPA-450/3-75-052) Avail: NTIS HC $7.00 CSCL 13B

The report is the second phase of a program to develop an airport air pollution impact methodology, involving modifications to aircraft ground operations to achieve emission reductions. The airport planning process was investigated to determine the points at which alternate strategies might be implemented. The principal evaluative tool was a Guassian plume description of pollutant dispersion. The five control strategies for aircraft studied were: (1) engine shutdown during taxi, (2) towing aircraft between runways and terminal gates, (3) capacity control, (4) fleet mix control, and (5) engine emission standards. GRA

N75-33545# Peat, Marwick, Mitchell and Co., Washington, D.C.
DEVELOPMENT OF A DEMAND FORECASTING FRAMEWORK FOR TEN INTERCITY CORRIDORS WITHIN THE UNITED STATES Final Report
Raymond H. Ellis and John C. Prokopy Jul. 1973 68 p
(Contract DOT-FR-20005)
(PB-242367/1; DOT-FR-20005-6) Avail: NTIS HC $4.25 CSCL 13B

The development, implementation, and results of an intercity

passenger travel demand forecasting framework are presented for ten corridors within the United States. The study is a portion of the overall multimodal DOT study of selected high density intercity corridors. The development of a data base of travel demand and impedances in the study corridors are presented. Next the demand forecasting process is described. Finally the sets of alternatives tested and supporting assumptions are presented. Basic sets of alternatives considered examined alternative rail services; the effects of energy shortages; CTOL, RTOL and STOL air services, and the relative effect of distance on various rail services share of demand. GRA

N75-33546# Volkert (David) and Associates, Bethesda, Md. Environmental Planning and Engineering Div.
MONOGRAPH OF THE EFFECTIVENESS AND COST OF WATER TREATMENT PROCESSES FOR THE REMOVAL OF SPECIFIC CONTAMINANTS: VOLUME 1: TECHNICAL MANUAL Final Report
Ian C. Watson, Stephen J. Spano, Howard N. Davis, and Frederick M. Haider Aug. 1974 332 p refs
(Contract EPA-68-01-1833)
(PB-242442/2; EPA-430/9-75-008-Vol-1) Avail: NTIS HC $9.50 CSCL 13B

Treatment processes for potable water supplies and their costs are examined. General cost estimates for the removal or reduction of contaminant levels can be made by using the cost estimation curves and procedures outlined in the monograph. GRA

N75-33547# Environmental Protection Agency, Dallas, Tex.
ENVIRONMENTAL NOISE MONITORING AT THREE SITES IN IRVING, TEXAS, NOVEMBER-DECEMBER, 1974
George J. Putnicki and Hal Watson, Jr. Feb. 1975 67 p refs
(PB-242567/6; EPA-906/9-75-001) Avail: NTIS HC $4.25 CSCL 13B

Noise exposures were sampled and evaluated in a community adjacent to Dallas/Fort Worth Airport where aircraft noise complaints have multiplied. The day-night average sound level at three sites was measured for each of seven days using prototype, automatic computerized sound sampling systems, and a special iteractive tape recording system. Results were spot-checked with convential equipment. The noise exposure was within the error tolerances of the NEF-CNR contour map predicted for Dallas/Fort Worth airport although it exceeded the EPA guideline of 55 dBA Ldn. Aircraft from Dallas/Fort Worth were identified as a major noise source. GRA

N75-33548# Environmental Protection Agency, Washington, D.C. Office of Noise Abatement and Control.
BACKGROUND DOCUMENT FOR INTERSTATE MOTOR CARRIER NOISE EMISSION REGULATIONS
Oct. 1974 86 p refs
(PB-242554/4; EPA-550/9-74-017) Avail: NTIS HC $4.75 CSCL 13B

Factual information is presented used by EPA which led to the requirements of the motor carrier regulation. Topics discussed are: regulatory strategy, technology for quieting in-use vehicles, costs, measurement methodology, and economic impact. Truck noise sources are analyzed to determine regulatory maximum levels which are consistent with available retrofit technology. Data are presented on relative stringency between the engineering test used by industry and the roadside tests specified by EPA. GRA

N75-33549# Environmental Health Lab., McClellan AFB, Calif.
WASTEWATER TREATMENT EVALUATION, MATHER AFB, CA. Final Report
Chester F. Pauls Jun. 1974 109 p refs
(AF Proj. WDF-202)
(AD-A010872; EHL-M-74M-8) Avail: NTIS CSCL 13/2

A survey of the Wastewater Treatment Facilities at Mather AFB, CA. was performed. Sources of industrial and domestic wastes were reviewed. Treatment facility performance and effluent characteristics were determined. Recommendations to improve the treatment of wastewater and to eliminate untreated discharges are presented. Performance specifications applicable to the wastewater treatment facility are provided. GRA

N75-33688* California Univ., Los Angeles. Biotechnology Lab.
FREQUENCY MODULATED CUTANEOUS ORIENTATION FEEDBACK FROM ARTIFICIAL ARMS
Moshe Solomonow, Amos Freedy, and John Lyman *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 180-191 refs (For availability see N75-33675 24-54)
(Contract V-101-(134)P121)
CSCL 05H

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N75-33550 Polytechnic Inst. of New York.
IONOSPHERIC DISTURBANCES AND GRAVITY WAVES Ph.D. Thesis
Hee Joon Eun 1975 181 p
Avail: Univ. Microfilms Order No. 75-21361

Traveling ionospheric disturbances were studied by utilizing hydrodynamic equations for electrons and ions as well as Maxwells Equations. Equations were solved to determine density perturbations of these particles, then compared with solutions based on diffusion theory. In addition, an attempt was made to interpret the multiple traces on an ionogram for irregularity information. A mathematical expression for the physical process was developed and manipulated to determine the initial angle or propagation for a returning echo as a function of the horizontal perturbation parameter, alpha, and x sub m, the position of the center of maximum perturbation. It was then possible to construct an ionogram with the aid of ray equations, with alpha and x sub m as the running variables. Comparisons of this ionogram with one obtained by observation permitted the determination of not only the magnitude of perturbation but also irregularity velocity. Dissert. Abstr.

N75-33551 Pennsylvania State Univ., University Park.
CRACK DISTRIBUTION UNDER UNIAXIAL LOAD AND ASSOCIATED CHANGES IN SEISMIC VELOCITIES PRIOR TO FAILURE Ph.D. Thesis
Robert L. Rothman 1975 143 p
Avail: Univ. Microfilms Order No. 75-22707

Cylindrical rock specimens were uniaxially stressed to failure while strains, compressional and polarized shear wave velocities, and acoustic emissions were recorded. The velocities of compressional and shear waves propagating parallel to the stress direction generally increased with applied stress. Compressional wave velocities normal to the applied stress generally increased slightly with load and then decreased as the rocks dilated. Shear waves propagating normal to the applied stress also initially increased in velocity as the stress increased, then started to decrease at about 50% of the fracture strength. Specimens subjected to several cycles of loading and unloading displayed non-recoverable hysteresis, suggesting that cracks formed during loading remained open after the load was removed. Acoustic emissions measurements revealed that most large events occurred at stresses above 90% of the strength of the rock. Compression wave radiation patterns and direct examination indicated that these events were due to tension cracks formed parallel to the direction of applied compression. Dissert. Abstr.

N75-33552 New York Univ., N.Y.
STABILITY OF GEOSTROPHIC VORTICES ON A ROTATING SPHERE Ph.D. Thesis
Carlos Alejandro Leiva-Pedrasa 1975 213 p
Avail: Univ. Microfilms Order No. 75-22904

The stability, under perturbation conditions, of four types of configurations of geostropic vortices was studied: (1) N vortices of equal strength mu equally spaced on a circle of colatitude theta, (2) N vortices of equal strength mu equally spaced on a circle of colatitude theta, one vortex with strength mu sub zero at the pole, (3) the same distribution as in (1) but satisfying the boundary condition: vanishing normal velocity component

at the equator, (4) the same distribution as (2) but satisfying the boundary condition: vanishing normal velocity component at the equator. Two main parts were distinguished: (1) the solution of an algebraic eigenvalue problem that arises from a linearized stability analysis of the nonlinear kinematic equations of vortex motion, and (2) the numerical solution of the nonlinear equations of vortex motion, which confirms, in some cases, the validity of linearized analysis and yields the magnitude of the perturbed motions. Dissert. Abstr.

N75-33553 California Univ., Los Angeles.
A SOLUTION OF THE RALEIGH SCATTERING PROBLEM FOR PLANE-PARALLEL ATMOSPHERES OF LARGE OPTICAL THICKNESS Ph.D. Thesis
Anne Bettine Kahle 1975 177 p
Avail: Univ. Microfilms Order No. 75-22635

The problem of radiative transfer in a plane-parallel, perfectly scattering atmosphere was described. Chandrasekhar's solution, applicable to atmospheres of small and moderate optical thicknesses, is outlined; this solution reduces the problem to that of determining the X-, Y-, K- and L- functions, the scattering functions. Mullikin's method, applicable to atmospheres of large optical thicknesses, was used to calculate the emergent radiation from plane-parallel Rayleigh-scattering atmospheres. The numerical results are given as tables of scattering functions. The numerical method for determining the intensity and polarization of the radiation emerging from the top and bottom of the atmospheres is given. A few examples of representative calculations are also presented. Dissert. Abstr.

N75-33554 Boston Coll., Chestnut Hill, Mass.
PHOTOMETRIC AURORAL OBSERVATIONS AT THE SOUTH POLE Ph.D. Thesis
Edward Joseph Weber 1975 170 p
Avail: Univ. Microfilms Order No. 75-21294

Auroral photometric measurements were obtained at the South Pole, throughout the austral winter of 1972. Observed auroral emissions included 4278 A N2(+), 4861 A H sub beta and 5577 A and 6300 A OI. A comprehensive study of auroral emissions and riometer absorption associated with the solar flare activity of August 1972 was conducted. Energetic solar protons measured by satellite detectors over the polar caps were found to be responsible for the measured 30 mHz absorption in the Northern and Southern Hemispheres. Because of their penetration depth, these protons account for only a small friction of the measured 4278 A N2(+), with the remainder of the emissions excited by protons and electrons of auroral energies. Simultaneous sensitive photometric measurements and riometer observations allow separation of precipitating particle species and characteristic energy. The daily variation of auroral features at the South Pole was investigated for quiet magnetic conditions. Zones which indicate precipitation of soft particles, slightly harder particles and protons, were identified. Dissert. Abstr.

N75-33555 Polish Academy of Sciences, Warsaw.
SOME PROBLEMS OF ELECTROMAGNETIC SOUNDING IN GEOLOGY [NIEKTORE ZAGADNIENIA ELEKTROMAGNETYCZNEGO SONDOWANIA GOROTWORU]
Marek Szalek 27 Feb. 1975 23 p refs In POLISH
Avail: Issuing Activity

Some physical problems and difficulties are presented which are connected with determining the geological structure of a selected formation region on the basis of electromagnetic field measurements. The reciprical electromagnetic problem is formulated and discussed along with the mathematical problems connected with the formulation. Algorithms are given for the problem. Transl. by M.J.S.

N75-33556*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEW SOURCE LOCATION MEASUREMENTS OF TERRESTRIAL KILOMETRIC RADIATION
M. L. Kaiser and J. K. Alexander Oct. 1975 18 p refs Presented at USNC/URSI Meeting, Boulder, Colo., 20-23 Oct. 1975 Submitted for publication
(NASA-TM-X-70990; X-693-75-256) Avail: NTIS HC $3.25 CSCL 08N

Two dimensional source locations of individual terrestrial kilometric radiation (TKR) events were measured by the Radio Astronomy Explorer-2 (RAE-2) spacecraft in lunar orbit. Although the average source location is above the polar regions near the earth there are a significant number of events which occur at > 7 RE from the earth. Furthermore, there is considerable evidence for multiple sources and source motion over the time scale of tens of minutes. Recent TKR mechanism theories which assume that the emission occurs at or near the local electron gyrofrequency would predict generation much closer to the earth's surface. It was suggested that alternative emission mechanisms (other than gyroemission) are required to explain all TKR events. Author

N75-33557*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RING CURRENT PROTON DECAY BY CHARGE EXCHANGE
Paul H. Smith, Robert A. Hoffman, and Theodore Fritz Oct. 1975 25 p refs Submitted for publication
(NASA-TM-X-70997; X-626-75-251) Avail: NTIS HC $3.25 CSCL 04A

Explorer 45 measurements during the recovery phase of a moderate magnetic storm have confirmed that the charge exchange decay mechanism can account for the decay of the storm-time proton ring current. Data from the moderate magnetic storm of 24 February 1972 was selected for study since a symmetrical ring current had developed and effects due to asymmetric ring current losses could be eliminated. It was found that after the initial rapid decay of the proton flux, the equatorially mirroring protons in the energy range 5 to 30 keV decayed throughout the L-value range of 3.5 to 5.0 at the charge exchange decay rate calculated by Liemohn. After several days of decay, the proton fluxes reached a lower limit where an apparent equilibrium was maintained, between weak particle source mechanisms and the loss mechanisms, until fresh protons were injected into the ring current region during substorms. While other proton loss mechanisms may also be operating, the results indicate that charge exchange can entirely account for the storm-time proton ring current decay, and that this mechanism must be considered in all studies involving the loss of proton ring current particles. Author

N75-33558*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
DOPPLER MEASUREMENTS OF THE IONOSPHERE ON THE OCCASION OF THE APOLLO-SOYUZ TEST PROJECT. PART 1: COMPUTER SIMULATION OF IONOSPHERIC-INDUCED DOPPLER SHIFTS
Mario D. Grossi and Ray H. Gay 10 Jul. 1975 85 p refs (Contract NAS9-13837)
(NASA-CR-119151; SAO-Special-Rept-366-Pt-1) Avail: NTIS HC $4.75 CSCL 04A

A computer simulation of the ionospheric experiment of the Apollo-Soyuz Test Project (ASTP) was performed. ASTP is the first example of USA/USSR cooperation in space and is scheduled for summer 1975. The experiment consists of performing dual-frequency Doppler measurements (at 162 and 324 MHz) between the Apollo Command Service Module (CSM) and the ASTP Docking Module (DM), both orbiting at 221-km height and at a relative distance of 300 km. The computer simulation showed that, with the Doppler measurement resolution of approximately 3 mHz provided by the instrumentation (in 10-sec integration time), ionospheric-induced Doppler shifts will be measurable accurately at all times, with some rare exceptions occurring when the radio path crosses regions of minimum ionospheric density. The computer simulation evaluated the ability of the experiment to measure changes of columnar electron content between CSM and DM (from which horizontal gradients of electron density at 221-km height can be obtained) and to measure variations in DM-to-ground columnar content (from which an averaged columnar content and the electron density at the DM can be deduced, under some simplifying assumptions).
Author

N75-33559*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
DOPPLER MEASUREMENTS OF THE IONOSPHERE ON THE OCCASION OF THE APOLLO-SOYUZ TEST PROJECT. PART 2: INVERSION OF DIFFERENTIAL AND ROTATING

DOPPLER SHIFTS
Ray H. Gay and Mario D. Grossi 11 Jul. 1975 42 p refs
(Contract NAS9-13837)
(NASA-CR-119152; SAO-Special-Rept-367-Pt-2) Avail: NTIS HC $3.75 CSCL 04A

The preparation of the analytical approach and of the related software used in the inversion of the differential and rotating Doppler data obtained from the ionospheric experiment of the Apollo-Soyuz Test Project (ASTP) is discussed. These data were collected in space-to-space paths (between the ASTP Docking Module (DM) and the Apollo Command Service Module and in space-to-ground paths (between the DM and ground). The Doppler links operated at 162 and 324 MHz and have an accuracy better than 3 MHz over 10-sec integration time. The inversion approach was tested with dummy data obtained with a computer simulation. It was found that a measurement accuracy of 1 to 10% in the value of the horizontal electron density gradient at 221-km altitude can be achieved, in space-to-space paths. For space-to-ground paths near the orbital plane, possible effects of the horizontal gradients on the received differential Doppler shifts were identified. It was possible to reduce the gradient-associated errors in the inversion that leads to the columnar electron content by approximately one-half. Accuracies of 5 to 10% in columnar electron content are achievable, with this gradient-compensation technique. Author

N75-33560# Norwegian Defence Research Establishment, Kjeller.
HIGH LATITUDE OBSERVATIONS OF ELECTRONS ABOVE 40 keV ENERGY BY THE ESRO 1A AND 1B SATELLITES
T. Wedde Nov. 1974 118 p refs
(NDRE-66) Avail: NTIS HC $5.25

The high latitude behavior of electrons greater than 40 keV during geomagnetic quiet and disturbed periods is summarized. Data were observed by ESRO 1A and 1B satellites and cover electron flux, scattering, precipitation, and universal time dependence. For individual titles, see N75-33561 through N75-33566.

N75-33561 Norwegian Defence Research Establishment, Kjeller.
ELECTRONS IN THE MAGNETOSPHERE
In its High Latitude Observations of Electrons above 40 keV Energy by the ESRO 1A and 1B Satellites Nov. 1974 p 6-20 refs (For availability see N75-33560 24-46)

A number of features of energetic electrons, as measured by the ESRO 1 satellites, are discussed. Author

N75-33562 Norwegian Defence Research Establishment, Kjeller.
ELECTRON OBSERVATIONS DURING GEOMAGNETICALLY QUIET PERIODS
In its High Latitude Observations of Electrons above 40 keV Energy by the ESRO 1A and 1B Satellites Nov. 1974 p 20-37 refs (For availability see N75-33560 24-46)

The behavior of electrons of greater than 40 keV energy during geomagnetically quiet periods was investigated. Both statistical results and data from individual satellite passes are presented. Author

N75-33563 Norwegian Defence Research Establishment, Kjeller.
ELECTRON MORPHOLOGY DURING GEOMAGNETICALLY DISTURBED PERIODS
In its High Latitude Observations of Electrons above 40 keV Energy by the ESRO 1A and 1B Satellite Nov. 1974 p 37-50 refs (For availability see N75-33560 24-46)

The large-scale structure of greater than 40 keV energy electrons, during periods characterized by a geomagnetic disturbance > 1 sub zero was studied. Author

N75-33564 Norwegian Defence Research Establishment, Kjeller.
ELECTRON OBSERVATIONS DURING NOVEMBER 1969
In its High Latitude Observations of Electrons above 40 keV Energy by the ESRO 1A and 1B Satellite Nov. 1974 p 50-69 refs (For availability see N75-33560 24-46)

The statistical electron morphology during geomagnetically disturbed periods is given. The investigation is restricted to electron behavior during a three week period in November 1969 during which a strong polar cap absorption event and a large magnetic storm occured. Times characterized by unusually quiet magnetic conditions were also considered. Emphasis was placed on presenting the state of the outer radiation belt and polar cap region in the Northern Hemisphere as given by the electron data during various levels of disturbance. A comparison was made between the statistical electron structure and the information derived from individual satellite passes. Author

N75-33565 Norwegian Defence Research Establishment, Kjeller.
PITCH ANGLE DIFFUSION
In its High Latitude Observations of Electrons above 40 keV Energy by the ESRO 1A and 1B Satellite Nov. 1975 p 69-73 refs (For availability see N75-33560 24-46)

The use of pitch angle diffusion, caused by resonant wave-particle interactions, to account for the steady downpour of electrons and protons into the atmosphere is reported. Some implications of the theory are discussed and a comparison was made of theoretical deductions with ESRO 1A satellite data. Author

N75-33566 Norwegian Defence Research Establishment, Kjeller.
UNIVERSAL TIME VARIATIONS OF GREATER THAN 10 keV ENERGY ELECTRONS
In its High Latitude Observations of Electrons above 40 keV energy by the ESRO 1A and 1B Satellite Nov. 1975 p 73-118 refs (For availability see N75-33560 24-46)

A universal time dependence in electron behavior was investigated along with the loss cone concept and electron scattering in the atmosphere. Author

N75-33567*# Scientific Translation Service, Santa Barbara, Calif.
RESULTS OF THE WORLD SPACE RESEARCH, 1966/67
Harro Zimmer Washington NASA Oct. 1975 13 p Transl. into ENGLISH from Weltraumfahrt (West Ger.), v. 18, no. 5, Sep. - Oct. 1967 p 138-141
(Contract NASw-2791)
(NASA-TT-F-16634) Avail: NTIS HC $3.25 CSCL 04A

Lectures presented at the 1967 joint meeting of the Committee on Space Research and the International Quiet Sun Year are reviewed. Solar radiation, earth radiation belts, lunar exploration, interplanetary dust, atmospheric composition, and space medicine and biology were among the topics considered. D.M.L

N75-33568*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE DETERMINATION OF ATMOSPHERIC PATH LENGTH BY PASSIVE MICROWAVE RADIOMETER
William J. Webster, Jr. May 1975 26 p refs
(NASA-TM-X-70976; X-922-75-107) Avail: NTIS HC $3.75 CSCL 04A

Microwave radiometer techniques were evaluated for use in atmospheric path length correction of Pacific Plate Motion Experiment interferometer measurements. It is shown that passive microwave radiometry allows precise measurement of the brightness temperature of the sky. It is also noted that the technological requirements of radiometers are very different from the requirements of radio astronomy. The technology was used in the construction of radiometers which are sufficient for use in the path length correction problem. A simulation study shows that, when combined with surface meteorology data, passive microwave radiometer data would allow a determination of the path length correction to better than 2 cm at the zenith. By a careful choice of frequencies, a dual frequency system would allow a measurement of the path length correction to better than 4 cm at zenith angles as great as 60 deg. Because of the wide range of weather conditions to be expected for the PPME sites (which include Alaska, Hawaii and Massachusetts), it will probably be necessary to use a separate correction algorithm for each site. Author

N75-33569# Royal Aircraft Establishment, Farnborough (England).
ANALYSIS OF THE ORBIT OF 1970-97B (COSMOS 378 ROCKET)
H. Hiller Dec. 1974 21 p refs
(RAE-TR-74161; BR44786) Avail: NTIS HC $3.25

The main aim of the analysis was to determine the atmospheric rotation rate from the decrease in orbital inclination, which was

determined with a mean standard deviation of 0.0010 deg and a best standard deviation of 0.0003 deg. Cosmos 378 rocket, 1970-97B, entered orbit on 17 November 1970, with orbital inclination 74.0 deg, period 105 min and perigee height 230 km, and decayed on 30 September 1972 after 683 days in orbit. The RAE computer program PROP was used, with more than 1900 observations from 64 stations, to determine the orbit at 39 epochs between February 1971 and September 1972. After removal of relevant perturbations, analysis of the variation in inclination between July 1971 and April 1972 yields the surprisingly low average atmospheric rotation rate of 0.75 plus or minus 0.05 rev/day, at a mean height of 250 km. The local time at perigee is however strongly biassed towards daytime values (07-16 h), so the results lend support to the picture of east-to-west winds by day and west-to-east winds by night. Values of scale are obtained by analysis of the change in perigee height. Author (ESRO)

N75-33570# Soil Conservation Service, Washington, D.C.
HEAT BALANCE
T. G. Berlyand 1975 138 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (USSR), no. 283, 1970 Sponsored in part by NSF
(TT-73-52019) Avail: NTIS HC $5.75 CSCL 04A

Results of investigations on the heat and water balances of the globe are presented in a series of papers. Topics discussed include: utilization of the data on heat balance; development of applied climatology and bioclimatology; radiation regimes of Africa and mountainous regions; influence of the water and heat regimes on productivity of plants; reduction of atmospheric transmittance; rate of melting of snow, firn, and ice in the mountains as a function of temperature and solar radiation; and carbon dioxide fluxes as indexes of productivity of vegetation. GRA

N75-33571# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
COMPOSITE PCA '69 STUDY Final Report
17 Mar. 1975 52 p refs
(DNA Proj. NWED-QAXH)
(AD-A011602; AFCRL-ERP-500; AFCRL-TR-75-0149) Avail: NTIS CSCL 04/1

Data gathered during the 2 to 5 November 1969 polar cap absorption (PCA) event (or solar proton event-SPE) are summarized in this report. The atmospheric implications and findings are discussed in terms of five broad categories; Electron loss coefficients, Ion chemistry results, Neutral/motions results, UV/visible/IR results, and Electromagnetic propagation results. GRA

N75-33572# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
STRONG MOTION EARTHQUAKE ACCELEROGRAMS DIGITIZED AND PLOTTED DATA. VOLUME 1: UNCORRECTED ACCELEROGRAMS. PART S: ACCELEROGRAMS IS255 THROUGH IS273. ACCELEROGRAMS FROM THE SAN FERNANDO, CALIFORNIA EARTHQUAKE OF FEBRUARY 9, 1971
A. G. Brady and D. E. Hudson Oct. 1974 386 p refs
(Grant NSF GI-28098)
(PB-241551/1; EERL-74-24-Vol-1) Avail: NTIS HC $10.25; HC also available from NTIS $31.00/set of 4 reports as PB-241550-SET CSCL 08K

The San Fernando earthquake provided records of sufficient importance that the original plan was interrupted after two parts and Part C contained the first of the San Fernando earthquake accelerograms. This issue completes the San Fernando accelerograms and contains nineteen records consisting of three records each from the buildings at 6200 Wilshire Blvd., 3440 University Ave., 5900 Wilshire Blve., and 5260 Century Blvd.; two records from the building at 11661 San Vicente Blvd.; and one record from the buildings at 1177 Beverly Dr., 3435 Wilshire Blvd., 3550 Wilshire Blvd., 930 Hilgard Blvd., and 15433 Ventura Blvd.; all in Los Angeles. GRA

N75-33573# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
STRONG MOTION EARTHQUAKE ACCELEROGRAMS DIGITIZED AND PLOTTED DATA. VOLUME 2: CORRECTED ACCELEROGRAMS AND INTEGRATED GROUND VELOCITY AND DISPLACEMENT CURVES. PART S: ACCELEROGRAMS IIS255 THROUGH IIS273
M. D. Trifunac Oct. 1974 223 p refs
(Grant NSF GI-28098)
(PB-241552/9; EERL-74-57-Vol-2) Avail: NTIS HC $7.25; HC also available from NTIS $31.00/set of 4 reports as PB-241550-SET CSCL 08K

The final accelerograms obtained during the San Fernando earthquake on Feb. 9, 1971 are reported and are comprised of 3 records each from the buildings at 6200 Wilshire Blvd., 3440 University Ave., 5900 Wilshire Blvd., and 5260 Century Blvd.; 2 records from the building at 11661 San Vicente Blvd.; and 1 record each from the buildings at 1177 Beverly Dr., 3435 Wilshire Blvd., 3550 Wilshire Blvd., 930 Hilgard Ave., and 15433 Ventura Blvd.; all in Los Angeles. GRA

N75-33574# California Inst. of Tech., Pasadena. Earthquake Engineering Lab.
ANALYSES OF STRONG MOTION EARTHQUAKES ACCELEROGRAMS. VOLUME 3: RESPONSE SPECTRA. PART S: ACCELEROGRAMS IIS255 TO IIS273
M. D. Trifunac, A. G. Brady, and D. E. Hudson Oct. 1974 251 p refs
(Grant NSF GI-28098)
(PB-241553/7; EERL-74-86-Vol-3) Avail: NTIS HC $8.50; HC also available from NTIS $31.00/set of 4 reports as PB-241550-SET CSCL 08K

This is one of a series of reports presenting earthquake response spectrum curves calculated from corrected accelerograms are presented. In the preface to the first part, Vol. 3, Part A, Report No. EERL 72-80, there is a summary of response spectrum techniques in earthquake engineering which is available as background material for the data. For each earthquake accelerogram, two spectrum plots are given-relative velocity response versus period on a linear scale, and a tripartite log-log plot giving relative displacement pseudo-velocity, and pseudo-acceleration spectra. The Fourier spectrum is also shown on the linear plot. Digital printout of ordinates of the plotted curves are tabulated for each earthquake. The records analyzed in this report, Vol. 3, Part S, are the corrected accelerogram records contained in Vol. 2, Part S, Report No. EERL 74-57, and appeared in their uncorrected form in Vol. 1, Part S, Report No. EERL 73-24. GRA

N75-33575# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
ANALYSES OF STRONG MOTION EARTHQUAKE ACCELEROGRAMS. VOLUME 4: FOURIER AMPLITUDE SPECTRA. PARTS Q, R, AND S: ACCELEROGRAMS IIQ233 TO IIQ243, IIR244 TO IIR254, AND IIS255 TO IIS273
M. D. Trifunac Oct. 1974 281 p refs
(Grant NSF GI-28098)
(PB-241554/5; EERL-74-104) Avail: NTIS HC $8.75; HC also available from NTIS $31.00/set of 4 reports as PB-241550-SET CSCL 08K

Fourier amplitude spectra are presented for earthquake ground motions and for structural response accelerations. For each earthquake accelerogram, two spectrum plots are given - a Fourier amplitude spectrum versus frequency on a linear scale and a log-spectrum, log-frequency plot. Fourier amplitude spectra is given for all corrected accelerograms, including building response measurements. GRA

N75-33576# Ohio State Univ., Columbus. Dept. of Geodetic Science.
GRAVITY ANOMALY RECOVERY FROM SATELLITE ALTIMETRY DATA USING LEAST SQUARES COLLOCATION TECHNIQUES
Richard H. Rapp Dec. 1974 31 p refs
(Contract F19628-72-C-0120; AF Proj. 8607)
(AD-A009630; DGS-220; SR-23; AFCRL-TR-74-0642) Avail: NTIS CSCL 08/5

The prediction of mean gravity anomalies from other anomalies and satellite altimeter data is described using the technique of least squares collocation. The equations derived are then used in simulation studies, using altimeter data alone, to estimate the accuracy to which mean gravity anomalies can be determined

with respect to an ellipsoidal reference field and a degree 12 reference field. GRA

N75-33577# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

TABLES OF ASYMPTOTIC DIRECTIONS AND VERTICAL CUTOFF RIGIDITIES FOR A FIVE DEGREE BY FIFTEEN DEGREE WORLD GRID USING THE FINCH AND LEATON GEOMAGNETIC FIELD MODEL Environmental Research Papers

M. A. Shea, D. F. Smart, J. R. McCall, and B. S. Gumm 22 Jan. 1975 164 p refs

(AF Proj. 8600)

(AD-A010426; AFCRL-TR-75-0042; AFCRL-ERP-498) Avail: NTIS CSCL 04/1

Tables of asymptotic directions and vertical cutoff rigidities for a five degree by fifteen degree world grid are presented. These values were obtained by the integration of vertically incident cosmic-ray trajectories through the Finch and Leaton (Epoch 1955) quiescent model of the geomagnetic field. The table of asymptotic directions contains the asymptotic latitudes and longitudes that specify the direction of approach, from interplanetary space, of a cosmic-ray particle. These asymptotic directions are given for each grid point for specific rigidities above the main cone cutoff rigidity. The table of vertical cutoff rigidities contains the geographic coordinates and L value of each location, together with the main cone cutoff rigidity, the Stormer cutoff rigidity, and the effective cutoff rigidity. GRA

N75-33578# Naval Postgraduate School, Monterey, Calif.

HEAT BUDGET PARAMETERIZATION FOR THE FNWC PRIMITIVE EQUATION MODEL USING DATA FOR 16 JANUARY 1974 M.S. Thesis

Warren Theodore Spaeth, Jr. Mar. 1975 153 p refs

(AD-A009977) Avail: NTIS CSCL 04/1

The radiational model employed here computes the planetary albedo and the solar absorption by atmospheric layers and by earth's surface for the primitive equation model of FNWC. Large-scale cloud parameterization in several layers enters into these computations. The solar computations are made on a gridpoint basis employing the water-vapor mass over each gridpoint. Longwave cooling effects over the same layers and at the earth's surface are calculated using emissivity formulas after Sasamori, and are also dependent upon the cloud-parameterizations. Two forms of the cloud-parameterizations were tested using FNWC gridpoint oceanic data for 16 January 1974. The objective was to determine the parameterization which better verified the radiational balance as a function of latitude at the tropopause, as compared with the January satellite climatology. Separate heat-budget checks of the propospheric columns and of the oceanic-water mass were tested for consistency with January climatology. The smaller cloud-parameterization values gave the best verification. GRA

N75-33579# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

AN UPDATED EMPIRICAL DENSITY MODEL FOR PREDICTING LOW ALTITUDE SATELLITE EPHEMERIDES Air Force Surveys in Geophysics

Henry B. Garrett 19 Mar. 1975 23 p refs

(AF Proj. 6690)

(AD-A010424; AFCRL-TR-75-0158; AFCRL-AFSIG-305) Avail: NTIS CSCL 04/1

Two empirical density models based on drag analyses of 22 low-perigee satellites are developed for use in predicting low-altitude satellite ephemerides. A stepwise multiple regression analysis is performed with density at 145 km as the dependent variable, and a number of independent variables chosen to represent variations with solar cycle, geomagnetic activity, latitude, season, day of the year, and time of day. Densities between 120 and 500 km are determined from the hydrostatic law in a simple (but physically realistic) analytic form. The two models compare very well with the 1971 Jacchia model. The main advantage of such models is that they represent a major savings in both computer storage and run time making possible improvements in operational systems. GRA

N75-33580# National Oceanic and Atmospheric Administration, Boulder, Colo.

ZONAL PROFILES OF ATMOSPHERIC WATER VAPOR

P. M. Kuhn Mar. 1975 16 p refs

(COM-75-10733/4; NOAA-TR-ERL-319-APCL-33; NOAA-75050902) Avail: NTIS HC $3.25; HC also available from SOD as C55.13:ERL-319-APCL-33 CSCL 04A

Water vapor burden and in situ mixing ratios at high altitude flight levels were inferred from observations in the rotational water vapor spectral band. The method of radiance observations to infer water vapor burden and concentration, while radiometric, involved emission observations rather than absorption spectra analysis. The east-west flights were made during the February through December, 1974, period. Profiles are given of lower stratospheric and upper tropospheric water vapor from 30 to 50 degrees North latitude between 90 and 140 degrees West longitude. GRA

N75-33581# Science Applications, Inc., La Jolla, Calif.

A STUDY ON THE DETERMINATION OF THE ATMOSPHERIC AEROSOL CONTENT USING ERTS DATA Final Report

M. Griggs 17 Apr. 1975 18 p refs

(Contract NOAA-4-35365)

(COM-75-10751/6; SAI-75-566-LJ; NOAA-75050704) Avail: NTIS HC $3.25 CSCL 04A

A linear relationship between the upwelling radiance over water surfaces and the atmospheric aerosol content, indicated by ERTS 1 data, was investigated further. This study identified seven NOAA-EPA network sites, plus the NASA-Houston network within the Houston area, as being suitable for providing data points for the investigation. Analysis of ERTS 1 and turbidity data for the period July 1972 to May 1973 revealed 24 possible data points. Most of these turbidity values were below the normal aerosol contents and just two high values were judged suitable for checking the relationship where data points are presently sparse. It is recommended that the study be extended to cover ERTS 1 data for the period from May 1973 to January 1975, and to include the current and future Landsat 1 and 2 coverage which provide data every 9 days at each site. GRA

N75-33582# Michigan State Univ., East Lansing. Dept. of Civil Engineering.

CYCLIC TRIAXIAL TEST EQUIPMENT TO EVALUATE DYNAMIC PROPERTIES OF FROZEN SOILS Final Report

Ted S. Vinson Mar. 1975 43 p refs

(Grant NSF GK-37439)

(PB-242419/0; MSU-CE-75-1) Avail: NTIS HC $3.75 CSCL 08M

To establish the response interaction between a soil deposit and a structure during an earthquake, two soil properties are required: (1) the dynamic shear modulus, and (2) the damping factor. The results of a research program to develop test equipment to evaluate the shear moduli and damping factors of frozen soils for use in ground response analyses during earthquakes, and develop a research plan to investigate parameters that might influence shear moduli and damping factors of frozen soils are presented. GRA

N75-33583# Science Applications, Inc., La Jolla, Calif.

ELECTRON ENERGY DEGRADATION IN THE ATMOSPHERE: CONSEQUENT SPECIES AND ENERGY DENSITIES, ELECTRON-FLUX, AND RADIATION SPECTRA Topical Report, 7 Jan. - 7 Sep. 1974

Benjamin F. Myers and Melvin R. Schoonover 3 Jan. 1975 76 p refs

(Contract DNA001-74-C-0149)

(AD-A010919; SAI-74-719-LJ; DNA-3513T) Avail: NTIS CSCL 04/1

A method is presented which describes the discrete energy loss undergone by electrons resulting from absorption events. The initial species, the partitioning of energy, the electron-flux spectra, and radiation band profiles resulting from energy degradation of electrons are calculated for atmospheric compositions corresponding to altitudes between 60 and 145 km and for initial electron energies of 14 to 900 eV. GRA

N75-33584# Naval Research Lab., Washington, D.C.
ADVECTION OF ARTIFICIALLY PRODUCED UPPER ATMOSPHERIC CLOUDS IN EMPIRICALLY DETERMINED WIND FIELDS
S. T. Zalesak and T. P. Coffey Apr. 1975 31 p refs Sponsored by DNA
(AD-A011049; NRL-MR-3046) Avail: NTIS CSCL 18/3

The present work is part of an effort to develop a complete and accurate model for the three-dimensional motion of radioactive nuclear weapon debris released in the earth's atmosphere at altitudes from 25 km to 130 km. The time development of passive cloud surfaces in a empirically derived seasonally dependent mean zonal and meridional wind field is followed using a very simple advection code. Zonal wind fields are based on Groves: CIRA 1972 model and meridional fields are based on a 1969 paper by the same author. Both models are fits to extensive experimental data, time averaged over one-month time intervals. Test runs are presented, showing the effects of releasing the cloud during different months and at different points over the earth. GRA

N75-33585# Maryland Univ., College Park. Dept. of Mechanical Engineering.
APPLICATION OF HOLOGRAPHY TO A STUDY OF WAVE PROPAGATION IN ROCK Technical Report, 1 Apr. - 1 Nov. 1974
D. C. Holloway and A. M. Patacca Jan. 1975 40 p refs
(Grant NSF GI-39320)
(PB-242366/3; NSF/RA/T-75-017) Avail: NTIS HC $3.75 CSCL 19D

Double exposure holography using a pulsed ruby laser was employed to record the surface displacements in westerly granite rock models of a half space. The explosive excitation was produced by 100 to 200 mg of lead azide on the free surface of the specimens. Mirrors were used so that three widely separated views of the surface were obtained thus allowing for the solution of the u, v, and w displacements corresponding to a x, y, z axis on the rock face. A radial line from the explosive center was analyzed in detail and the solution was correlated with theory. GRA

N75-33586# Computer Corp. of America, Cambridge, Mass.
DATACOMPUTER SUPPORT SEISMIC DATA ACTIVITY Quarterly Technical Report, 1 Feb. - 30 Apr. 1975
30 May 1975 16 p
(Contract MDA903-74-C-0227; ARPA Order 2613)
(AD-A010556) Avail: NTIS CSCL 08/11

The purpose of the project is to support the ARPA-NMRO Seismic Data Activity by providing data storage and retrieval services. GRA

N75-33587# Royal Norwegian Council for Scientific and Industrial Research, Kjeller.
NORWEGIAN SEISMIC ARRAY (NORSAR), PHASE 3 Quarterly Progress Report, 1 Jan. - 31 Mar. 1975
K. A. Berteussen 11 Apr. 1975 26 p refs
(Contract F08606-74-C-0049; ARPA Order 2551)
(AD-A010586; QR-1) Avail: NTIS CSCL 17/10

The report covers operation and research activities at the Norwegian Seismic Array (NORSAR) in the period 1 January - 31 March 1975. Both for the field and data center installations this has been a stable period. Two studies of scattering in the crust and upper mantle and one study of scattering in the mantle-core boundary have been finished. A Kirnos verticle broadband instrument has been operated at the subarray 04B over a period of about nine months, and the results from this project are now available. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N75-33588*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DATA FOR NASA'S AVSSE 2 EXPERIMENT: 25-mb SOUNDING DATA AND SYNOPTIC CHARTS
Nancy F. Fucik (Texas A and M Univ., College Station) and Robert E. Turner Oct. 1975 185 p refs
(Contract NAS8-26751)
(NASA-TM-X-64957) Avail: NTIS HC $7.00 CSCL 04B

This report describes the AVSSE II Experiment and presents tabulated rawinsonde data at 25 mb intervals from the surface to 25 mb for the 23 stations participating in the experiment. Soundings were taken between 1200 GMT, May 6 and 1200 GMT, May 7, 1975. Brief discussions are given on the methods of data processing and accuracy. Synoptic charts prepared from the data are presented, as well as an example of contact data. Author

N75-33589# Committee on Agriculture and Forestry (U. S. Senate).
WEATHER MODIFICATION GRANTS
Washington GPO 1974 142 p refs Hearing on S. 3313 before Subcomm. on Agr. Res. and Gen. Legislation of Comm. on Agr. and Forestry, 93d Congr., 2d Sess., Lawton, Okla., 19 Aug. 1974
(GPO-41-959) Avail: Subcomm. on Agr. Res. and Gen. Legislation

Testimony is provided on progress made and experiments conducted in the area of weather modification in terms of drought prevention. Topics discussed include: climate and agriculture economy, cloud seeding, long range predictions of precipitation, and the effect of solar variations on weather. The effectiveness of weather modification programs in Texas, Oklahoma, New Mexico, and South Dakota is examined. It is proposed to formulate and carry out an emergency weather modification program in any State in which livestock or crops are threatened because of drought conditions. J.M.S.

N75-33590# World Meteorological Organization, Geneva (Switzerland).
TYPHOON MODIFICATION
1975 154 p refs Proc. of WMO Tech. Conf., Manila, 15-18 Oct. 1974
(WMO-408; ISBN-92-63-10408-5) Avail: NTIS HC $6.25; WMO, Geneva

Papers were presented in the following fields: tropical cumuli and typhoon characteristics (including forecasting, modelling, and storm surges); typhoon modification; operational aspects of tropical cyclone modification activities; and physical, statistical, and economic evaluation of tropical cyclone modification activities. For individual titles, see N75-33591 through N75-33604.

N75-33591 Toronto Univ. (Ontario). Dept. of Physics.
THE WARM-RAIN MECHANISM: ITS MODELLING AND MODIFICATION
Roland List *In* WMO Typhoon Modification (date) p 1-8 refs Sponsored in part by Can. Atmospheric Environment Serv. and US Dept. of Commerce (For availability see N75-33590 24-47)
Copyright.

The different steps of rain formation are described, and the possible types and mechanisms of interference with the rain making process are discussed. Aspects of cloud modelling are considered, and modification of the warm-rain mechanism through particle kinetics is discussed. ESA

N75-33592 World Meteorological Organization, Geneva (Switzerland).
TYPHOON CLIMATOLOGY IN RELATION TO WEATHER MODIFICATION ACTIVITIES
Roman L. Kintanar (Philippine Atmospheric, Geophys. and Astronomical Serv. Admin.) and Leoncio A. Amadore (Philippine Atmospheric Geophys. and Astronomical Serv. Admin.) *In its* Typhoon Modification 1975 p 9-17 refs (For availability see N75-33590 24-47)
Copyright.

The frequency of occurrence, intensity, and speed of movement of tropical cyclones in the Philippine Area of Responsibility (PAR) are considered. The seasonal and geographical variations of these parameters are briefly discussed and the results given. Northern Luzon is the region most frequently hit

by tropical cyclones so that most of the typhoon modification experiments may be expected over the ocean east of this area. The variability of maximum winds around tropical cyclones makes the evaluation of typhoon modification experiments doubly difficult. The average speed of forward movement of tropical cyclones in the PAR was found to be 11.1 knots. ESA

N75-33593 World Meteorological Organization, Geneva (Switzerland).
OBSERVATIONS OF THE SIZE OF THE TYPHOON EYE
Gordon J. Bell *In its* Typhoon Modification 1975 p 19-29 refs (For availability see N75-33590 24-47)
Copyright.

Experiments designed to reduce the maximum wind speed in a tropical cyclone may also cause changes in the diameter of its eye. The relative frequency of eye diameters is discussed and the relationship between eye diameter and pressure is considered. The geographical distribution of some of the features of the eye is also noted. ESA

N75-33594 National Oceanic and Atmospheric Administration, Silver Spring, Md. National Weather Service Techniques Development Lab.
SOME NUMERICAL EXPERIMENTS OF THE EFFECTS OF HURRICANE MODIFICATIONS ON STORM SURGES
Celso S. Barrientos and Chester P. Jelesnianski *In* WMO Typhoon Modification 1975 p 31-36 refs (For availability see N75-33590 24-47)
Copyright.

Some numerical experiments were performed to examine the effects of hurricane modifications on storm surges for alongshore-moving storms. A dynamical-numerical model was employed. Wind stress and atmospheric pressure gradient are the two driving forces generating the surges; the forces are derived from a dynamic storm model. Numerical experiments were done on an idealized standard basin. The peak surges on the coast due to storm modifications were examined. To illustrate the peak surges on the coast, two nomograms were constructed: one considers a continuum of storms with fixed track, the other a continuum of tracks for a fixed storm. The nomograms showed several features related to storm modifications. Simple correction factors were developed to consider a continuum of storms and tracks; these factors were derived from dynamical considerations and features of the nomograms. The correction factors are useful to estimate the peak surges without compiling atlases of nomograms. The results point out that if the scale size of a storm changes due to storm modification, then there is no general relation between peak surge and maximum wind; in fact, the distance of the storm from the coast--relative to storm size--is an important factor for peak surge. This means that any change in storm size--apart from changes in maximum wind--is also important for generation of storm surges.
Author (ESA)

N75-33595 Meteorological Research Inst., Tokyo (Japan).
CHARACTERISTICS OF STORM SURGES INDUCED BY TYPHOONS ALONG THE JAPANESE COAST
Masamori Miyazaki *In* WMO Typhoon Modification 1975 p 37-44 (For availability see N75-33590 24-47)
Copyright.

Storm surges along the Japanese coast are discussed and described using three typical cases. An attempt is made to show how the peak surge from the strength of a typhoon can be estimated. The frequency of storm surges and the patterns of time variations are noted and possible effects of typhoon modification are briefly discussed. ESA

N75-33596 National Oceanic and Atmospheric Administration, Miami, Fla. Environmental Research Lab.
TROPICAL CYCLONE MODIFICATION EXPERIMENTS
Cecil R. Gentry *In* WMO Typhoon Modification 1975 p 45-54 refs (For availability see N75-33590 24-47)
Copyright.

The results of hurricane modification experiments by cloud seeding (Project Stormfury) are reviewed and the modification hypothesis is discussed. The reasons beneficial modification can be achieved are explained and the procedures proposed for evaluating future experiments are discussed. Types of damage caused by tropical cyclones are described. ESA

N75-33597 National Oceanic and Atmospheric Administration, Miami, Fla.
NUMERICAL SIMULATION OF TYPHOON MODIFICATION EXPERIMENTS
Stanley L. Rosenthal *In* WMO Typhoon Modification 1975 p 55-66 refs (For availability see N75-33590 24-47)
Copyright.

The characteristics of two- and three-dimensional typhoon models are briefly detailed, and some numerical experiments relevant to typhoon modification are described. These experiments include seeding with silver iodide and applying artificial heating at the eyewall center. The results are summarized and a brief review of research in progress is also given. ESA

N75-33598 Denver Univ., Colo.
A HYPOTHESIS OF TROPICAL CYCLONE MODIFICATION BY CLOUD SEEDING
N. Fukuta *In* WMO Typhoon Modification 1975 p 67-77 refs (For availability see N75-33590 24-47)
(Grant NSF GA-29525)
Copyright.

A new hypothesis of tropical cyclone modification by reducing thermal energy by cloud seeding is presented. Thermal energy transfer during cloud processes is described and the general behavior of tropical cyclone and seeded cloud plumes is discussed. The reduction of thermal energy in the influx air of a tropical cyclone by the production of ice phase precipitation by proper seeding in rainband clouds is described. It is shown that absorption of the latent heat of fusion brought about by descending and melting ice particles in the eyewall zone of a tropical cyclone results in cooling of the lower air stream. It is suggested that this method be applied to control a tropical cyclone by seeding the rainband clouds and the eyewall clouds simultaneously to obtain an enhanced effect. ESA

N75-33599 World Meteorological Organization, Geneva (Switzerland).
THE TYPHOON RESEARCH PROJECT AS A SUPPORT ACTIVITY TO THE TYPHOON MODERATION PROGRAMME OF THE PHILIPPINES
Rodolfo A. DeGuzman *In its* Typhoon Modification 1975 p 79-89 refs (For availability see N75-33590 24-47)
Copyright.

The background and organization of the Typhoon Research Project (TRP) in the Philippines are outlined. Research by the TRP into typhoon structure and movement, typhoon moderation, flood forecasting, storm surges, and numerical weather analyses is described. ESA

N75-33600 World Meteorological Organization, Geneva (Switzerland).
PLANS FOR STORMFURY EXPERIMENTS, 1977 - 1978
Eugene Bollay *In its* Typhoon Modification 1975 p 91-99 (For availability see N75-33590 24-47)
Copyright.

The cloud seeding experiments already carried out under Project Stormfury are listed and seeding eligibility rules are given. The experimental design of the project is discussed and the goal for Project Stormfury in the Pacific is outlined. Experiments are discussed in detail. ESA

N75-33601 World Meteorological Organization, Geneva (Switzerland).
AN EXPERIMENTAL STUDY OF FLOOD CONTROL BY CLOUD SEEDING TECHNIQUE IN MALAYSIA
Hock Heng Teh and Tong Yuen Ho *In its* Typhoon Modification 1975 p 101-108 refs (For availability see N75-33590 24-47)
Copyright.

An experiment in Malaysia is discussed the object of which is to induce precipitation over the sea, thereby reducing the rainfall over land and avoiding floods. The background to cloud seeding is discussed and the target area and equipment described. The operational procedures, observation confirmed that seeding induced cloud dissipation over the sea and caused a 29% decrease in rainfall over land within 50 km from the coast. ESA

N75-33602 World Meteorological Organization, Geneva (Switzerland).

STATE OF WEATHER MODIFICATION IN THE PHILIPPINES
Ramon M. Macabuhay *In its* Typhoon Modification 1975 p 109-120 (For availability see N75-33590 24-47)
Copyright.

The present status of weather modification experiments in the Philippines is presented. Projects dealing with rainmaking, typhoon moderation, and cloud seeding are discussed. ESA

N75-33603 Virginia Univ., Charlottesville.
ON THE DESIGN AND EVALUATION OF TROPICAL CYCLONE SEEDING EXPERIMENTS
R. H. Simpson *In* WMO Typhoon Modification 1975 p 121-131 refs (For availability see N75-33590 24-47)
Copyright.

Using the experience of Project Stormfury, new instrumentation and a revision of seeding and monitoring procedures for tropical cyclone modification are proposed. Operational concepts and the scientific rationale for experiment design are discussed and comments on the Stormfury hypothesis are made. ESA

N75-33604 Hydrometeorological Scientific Research Center (USSR).
SOME INVESTIGATIONS OF TYPHOONS AND CLOUD MODIFICATION CONDUCTED IN THE USSR
L. S. Minina, D. I. Stekhnovsky, and N. I. Vulfson (Inst. of Appl. Geophys., Moscow) *In* WMO Typhoon Modification 1975 p 133-141 refs (For availability see N75-33590 24-47)
Copyright.

Theoretical studies and the numerical simulation of tropical cyclones are discussed together with their relationship to the intertropical convergence zone. The effects of cloud modification on cyclones is noted and a review of precipitation modification (rainmaking and hail suppression) is presented. Destruction of developing convection clouds is also considered. ESA

N75-33605# World Meteorological Organization, Geneva (Switzerland).
REPORT OF THE SEVENTH SESSION OF THE TROPICAL EXPERIMENT BOARD Global Atmospheric Research Program
Feb. 1975 31 p Conf. held at Geneva, 25-27 Feb. 1975 Prepared jointly with Intern. Council of Sci. Unions
(GARP-Spec-Rept-15) Avail: NTIS HC $3.75; WMO, Geneva

A report on the GATE field phase is presented together with a preliminary assessment. A progress report on data management is made followed by a report on International Scientific and Management Group publications, Joint Organizing Committee recommendations and other continuing GATE activities. Further plans of the TEB are also given. ESA

N75-33606# World Meteorological Organization, Geneva (Switzerland).
DROUGHT AND AGRICULTURE
C. E. Hounam, J. J. Burgos, M. S. Kalik, W. C. Palmer, and J. Rodda 1975 144 p refs
(WMO-392; TN-138; ISBN-92-63-10392-5) Avail: NTIS HC $5.75

A survey was made of the definitions of drought, classified according to whether they are based on rainfall only, on combinations of rainfall with temperature, humidity, wind, or evaporation, on soil moisture per se, or, more directly, on plant conditions. Special attention is given to various interpretations of the water-balance equation, one of the better-known examples being the Palmer model, which is explained in some detail. The drought resistance of plants and seeds, the use of fallow as a management technique, and the danger of erosion of drought-affected soils are discussed in a chapter on agricultural practices under drought conditions. The effects of drought on pastures and livestock are also considered. The associated water requirements are also discussed, and it is shown that hydrological practices and structures can be used to lessen the impact of drought. The influence of insects and pests are also considered. Author (ESA)

N75-33607# World Meteorological Organization, Geneva (Switzerland).
COMPARISON OF SENSORS AND TELEMETRY FOR METEOROLOGICAL ROCKETS Final Report
Robert Leviton 1975 114 p refs
(WMO-395; ISBN-92-63-10395-X) Avail: NTIS HC $5.25

A comparison of wind and temperature measurement data from Japanese, French, and American sounding rockets at Wallops Island and a similar comparison of French, British, American, and Russian rocket sensors at Kourou (French Guyana) were described. All systems produced compatible data from about 45 km down (Wallops Island) and 50 km down (Kourou). The most significant radiatorial effect is that caused by solar heating of the sensor. Author (ESA)

N75-33608# World Meteorological Organization, Geneva (Switzerland).
UTILIZATION OF AIRCRAFT METEOROLOGICAL REPORTS
S. Simplicio 1975 46 p refs Revised
(WMO-400; TN-141; TN-80-REV; ISBN-92-63-10400-X) Avail: NTIS HC $3.75

Current observing and reporting procedures for aircraft observations were reviewed. The use of air reports in analysis work and in numerical weather analysis and production is examined. The use of temperature, wind, turbulence, icing, pressure, weather, and cloud data obtained from all reports is described and the particular use of air reports in providing services to air navigation is considered. ESA

N75-33609# World Meteorological Organization, Geneva (Switzerland).
[WORLD WEATHER WATCH, RESEARCH ACTIVITIES, AND TECHNICAL PROGRAMS] Annual Report, 1974
1975 206 p
(WMO-412; ISBN-92-63-20412-8) Avail: NTIS HC $7.25

A brief general review of the activities of WMO and its constituent bodies was given, followed by detailed progress reports on the four main program areas: world weather watch, research program, program on the interaction of man and his environment, and technical cooperation program. Summaries on meteorological education and training, technical and support activities and external stations, and legal and administrative matters are also given. Author (ESA)

N75-33610# Stockholm Univ. (Sweden). Dept. of Meteorology.
ON THE VARIABILITY OF RAINWATER COMPOSITION AND ERRORS IN ESTIMATES OF AREAL WET DEPOSITION
Lennart Granat Jan. 1975 35 p refs
(Contracts SWED-EPB-7-206/72; SWED-EPB-7-142/73; SWED-NSRC-G-0223-061)
(AC-30) Avail: NTIS HC $3.75

Rainwater samples were collected monthly from 110 stations and daily from 104 stations and analyzed for major constituents. Results from 530 monthly and 435 daily samples are discussed. The data evaluated with regard to the quality representativeness of five ordinary network stations in the International Meteorological Institute (IMI) network include the small scale variability of rainwater concentration/deposition with precipitation for yearly, monthly, and daily collection periods. Uncertainties in wet deposition estimates for areas of different size and for different averaging times are discussed and, to some extent, quantified. Author (ESA)

N75-33611# Stockholm Univ. (Sweden). Dept. of Meteorology.
THE SULFATE/LIGHT SCATTERING RATIO: AN INDEX OF THE ROLE OF SULFUR IN TROPOSPHERIC OPTICS
A. P. Waggoner (Washington Univ., Seattle), A. H. VanDerPol, R. J. Charlson, Lennart Granat, Claes Traegaardh, and Steinar Larsen (Norweg. Inst. for Air Res.) Jun. 1975 19 p refs
(Grants NSF GA-27662; SWED-EPB-7-120/74; SWED-NSRC-G-0223-061)
(AC-33) Avail: NTIS HC $3.25

Measurements in Scandinavia of the light scattering coefficient with an airborne integrating nephelometer made simultaneously with sulfate mass concentration show a good correlation and agreement with theoretically predicted ratios of sulfate mass concentration to light scattering coefficient. This result suggests

that sulfate is often a dominant substance controlling visibility, turbidity, and radiative transfer. The data pairs for the ratio were obtained from aircraft flights. Flight conditions were selected to provide data for continental areas vs. maritime and to study sulfur transport across national boundaries and acidic rain. ESA

N75-33612# Stockholm Univ. (Sweden). Dept. of Meteorology.
ON INITIALIZATION FOR NUMERICAL MODELS FORMULATED FOR AN ALTERNATING GRID
Ulla Hammarstrand and Harald Lejenaes Feb. 1975 32 p refs
(Contract SWED-NSRC-G-0223-058)
(DM-15) Avail: NTIS HC $3.75

In a primitive model for numerical forecasting using an alternating grid for the integration, it is necessary to specify initial data for two sets of grid points. It is shown that better results are obtained if solving the balance equation for both sets, rather than only for one and deduce the other one by interpolation, although the improvement is modest.
Author (ESA)

N75-33613# RAND Corp., Santa Monica, Calif.
CUMULUS CLOUD ENERGETICS AS REVEALED IN A NUMERICAL MODEL OF CLOUD DYNAMICS
L. Randall Koenig and Francis W. Murray Apr. 1975 90 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-A010194; R-1613-ARPA) Avail: NTIS CSCL 04/2

The report investigates the effects of cumulus clouds on the temporal and spatial characteristics of atmospheric energy content. Changes in energy content of the cloud environment and the flux of energy are shown as functions of height and radial distance from the cloud axis. Energy related to water vapor accounts for most of the energy change in the cloud's vicinity. In the outer region, changes in water-vapor enthalpy are counterbalanced by changes in dry-air enthalpy, but potential energy change dominates. The total energy used in attempting to decrease conditional atmospheric instability is given by the total amount of energy produced by the condensate formed, regardless of whether it falls as rain. The study presents data which, together with reasonable assumptions about the natural occurrence of cloud cells, leads to an estimated relaxation time of convection of about ten hours. GRA

N75-33614# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF VERTICAL PROFILES OF MEAN TEMPERATURE, WIND AND HUMIDITY M.S. Thesis
Grant William Smedley, III Mar. 1975 44 p refs
(AD-A009981) Avail: NTIS CSCL 04/2

Shipboard measurements of the vertical profiles of mean humidity, temperature and wind speeds over the ocean have been investigated to verify their suitability to accepted turbulence similarity theory. In addition, the profiles have been used to obtain estimates of the temperature structure parameter. One hundred eighty-two profiles observed over a seven month period in 1974 aboard the R/V Acania in Monterey Bay have been compared to previous experimental results obtained in defining the meteorological parameters of friction velocity, roughness length, drag coefficient and the Richardson number. The temperature structure parameters computed from the profiles were provided to Lund (1975) for comparison with direct measurements. In general, favorable results were obtained in the parameter comparisons which provided additional support to the suitability of shipboard profile measurements defining the marine surface layer. GRA

N75-33615# Environmental Prediction Research Facility (Navy), Monterey, Calif.
A 26-YEAR TIME SERIES OF MONTHLY MEAN WINDS OVER THE OCEANS. PART 2: MONTHLY ANOMALIES AT SELECTED POINTS IN THE NORTH PACIFIC
Sigurd Erling Larson Apr. 1975 87 p refs
(WF52551713)
(AD-A010123; ENVPREDRSCHF-TECH-Paper-10-75) Avail: NTIS CSCL 04/2

Time series of surface wind vectors are presented for twenty-two points in the North Pacific in the form of monthly resultant zonal and meridional components and mean scalar wind speed. The quasi-geostrophic model (corrected for friction) used to compute the winds is briefly described and its accuracy is discussed. Monthly anomalies for the 312 months between January 1946 and December 1971 are presented in tabular form, along with the long (26 year) means for each month and the standard diviation of the monthly anomalies. Examples of interannual persistance of surface wind anomalies and the association of sea surface temperature and surface wind anomalies are presented. GRA

N75-33616# National Oceanic and Atmospheric Administration, Washington, D.C. Federal Coordinator for Meteorological Services and Supporting Research.
THE FEDERAL PLAN FOR METEOROLOGICAL SERVICES AND SUPPORTING RESEARCH, FISCAL YEAR 1976
Clayton E. Jensen Apr. 1975 87 p refs
(COM-75-10852/2; NOAA-75052013) Avail: NTIS HC $4.75; HC also available from SOD CSCL 04B

An overview is given of the federal expenditures over the past decade along with the improvements in the national forecast and warning system. This system includes monitoring the atmosphere, preparing forecasts and warnings, and disseminating forecasts and warnings in a rapid and efficient manner. Meteorological services are discussed in functional terms, such as observations, analyses and forecasts, communications, dissemination, and general agency support. The meteorological satellite program is included. GRA

N75-33617# Environmental Prediction Research Facility (Navy), Monterey, Calif.
DIRECT SOLUTION OF ELLIPTIC EQUATIONS BY BLOCK CYCLIC REDUCTION AND FACTORALIZATION
Thomas Rosmond and Frank Faulkner Apr. 1975 37 p refs
(AD-A010791; ENVPREDRSCHF-Tech-Note-20) Avail: NTIS CSCL 04/2

Poisson's and Helmholtz's equations are perhaps the most frequently occurring and important types of partial differential equations encountered in the atmospheric sciences. This paper presents a very fast, accurate technique for finding the numerical solution known as cyclic reduction and factoralization. This method has not heretofore been brought to the attention of the meteorological community at large. GRA

N75-33618# Naval Postgraduate School, Monterey, Calif.
A NUMERICAL PARAMETERIZATION OF WIND MIXING IN A TIME DEPENDENT BAROCLINIC OCEANIC GENERAL CIRCULATION MODEL M.S. Thesis
Robert William Davis Mar. 1975 56 p refs
(AD-A010833) Avail: NTIS CSCL 04/2

The study is directed toward improving an existing general circulation model (Haney, 1974) through the inclusion of time dependent surface boundary conditions and a wind mixing parameterization. Climatological atmospheric values, functions of time, provided the model the needed parameters in order to calculate solar insolation, longwave back radiation from the ocean, sensible heat exchange and latent heat exchange. The mixing parameterization involved the use of the Monin-Obukov length scale as a measure of the mixed-layer depth. The first law of thermodynamics was used to calculate the form of eddy flux above the mixed layer depth. A one-dimensional model using two different types of boundary conditions was used to test various parameters and ideas. The boundary condition similar to that used in the baroclinic model produced results through an interacting system that appeared similar to observations at Ocean Station N in the North Pacific Ocean. GRA

N75-33619# Naval Research Lab., Washington, D.C.
WINDVEL2: A PROGRAM FOR PLOTTING WIND VELOCITY AS DETERMINED BY OTH RADAR Final Report
Mark H. Etzel and Dennis B. Trizna Dec. 1974 39 p refs
(AD-A002954; NRL-MR-2935) Avail: NTIS CSCL 04/2

A FORTRAN program has been developed for displaying wind direction and wind speed data maps, as determined by the HF Over-the-Horizon Radar. The output products are a grid of wind direction arrows for each range/azimuth radar cell, and continuous contours of wind speed, plotted on a stereographic projection of the Northern Hemisphere about the North Pole by

a CALCOMP 565 plotter or compatible CRT display. Data inputted are generated by other programs described elsewhere, and include radar cell latitude and longitude, ambiguous wind direction pairs, and three independent values of wind speed, all of which can be plotted in a number of different combinations. GRA

N75-33620# Naval Postgraduate School, Monterey, Calif.
THE INCLUSIONS OF MOISTURE IN A NUMERICAL MODEL OF STEADY STATE FRONTS Technical Report, Jul. 1974 - Mar. 1975
C. J. Cornelius, Jr., D. F. Glevy, and R. T. Williams May 1975 55 p refs
(AD-A011096; NPS-51Wu75051) Avail: NTIS CSCL 04/2

The numerical frontogenesis model of Williams (1973) is modified to include moisture with its subsequent condensation and release of latent heating. The turbulent diffusions of momentum, heat and moisture are represented with various coefficients. The numerical solutions show realistic quasi-steady fronts forming within one to two days. These solutions are examined and compared over a range of the various coefficients, and various ranges of temperature. GRA

N75-33621# Stockholm Univ. (Sweden). Dept. of Meteorology.
ON THE DEPOSITION OF CHEMICAL SUBSTANCES BY PRECIPITATION (AS OBSERVED WITH THE AID OF THE ATMOSPHERIC CHEMISTRY NETWORK IN SCANDINAVIA)
Lennart Granat May 1974 27 p refs
(Contracts SWED-EPB-7-206/72; SWED-EPB-7-142/73; SWED-NSRC-G-0223-061)
(AC-27) Avail: NTIS HC $3.75

The importance of deposition by precipitation as a mechanism for the transport of atmospheric constituents to the ground is stressed. Analytic data on trace elements collected by the atmospheric chemistry network in Scandinavia are discussed. The statistical structure of the deposition field, as obtained from the network in Sweden, is evaluated, using known methods. The results are compared with supporting measurements of the mesoscale deposition picture around a few regular sampling stations and leads to a discussion of possible errors in areal deposition estimates with a given number of stations.
Author (ESA)

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N75-33622 Catholic Univ. of America, Washington, D.C.
THERMAL BOUNDARY LAYER OF WATER AT AN AIR-SEA INTERFACE: A NUMERICAL EXPERIMENT Ph.D. Thesis
Leslie John Pierre, Jr. 1975 142 p
Avail: Univ. Microfilms Order No. 75-21269

The thermal boundary layer in water at the air-sea interface was studied with the intention of simulating the boundary layer characteristics so as to obtain a better understanding of the complex interactions between the various mechanisms. Using a numerical simulation, a controlled experiment was performed to ascertain the effects of the various phenomena which might change the character of the boundary layer. The governing differential equations and boundary conditions were solved using finite difference equations based on Marker and Cell (MAC) techniques and a modified DuFort-Frankel time stepping scheme. Results indicate that the program predicts the characteristics of the boundary layer in agreement with the experimental work of other authors. Further analysis shows the dependence of the characteristics of the layer on heat exchange, sub-surface turbulence, and small amplitude gravity waves. The layer displays a logarithmic shape and extends to a few millimeters beneath the surface. Dissert. Abstr.

N75-33623*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
DEVELOPMENT OF AN AIRBORNE LASER BATHYMETER
Hongsuk Kim, H., Peter O. Cervenka (Computer Sci. Corp., Wallops Island, Va.), and Charles B. Lankford (Computer Sci. Corp., Wallops Island, Va.) Washington Oct. 1975 40 p refs
(NASA-TN-D-8079) Avail: NTIS HC $3.75 CSCL 08J

An airborne laser depth sounding system was built and taken through a complete series of field tests. Two green laser sources were tried: a pulsed neon laser at 540 nm and a frequency-doubled Nd:YAG transmitter at 532 nm. To obtain a depth resolution of better than 20 cm, the pulses had a duration of 5 to 7 nanoseconds and could be fired up to at rates of 50 pulses per second. In the receiver, the signal was detected by a photomultiplier tube connected to a 28 cm diameter Cassegrainian telescope that was aimed vertically downward. Oscilloscopic traces of the signal reflected from the sea surface and the ocean floor could either be recorded by a movie camera on 35 mm film or digitized into 500 discrete channels of information and stored on magnetic tape, from which depth information could be extracted. An aerial color movie camera recorded the geographic footprint while a boat crew of oceanographers measured depth and other relevant water parameters. About two hundred hours of flight time on the NASA C-54 airplane in the area of Chincoteague, Virginia, the Chesapeake Bay, and in Key West, Florida, have yielded information on the actual operating conditions of such a system and helped to optimize the design. One can predict the maximum depth attainable in a mission by measuring the effective attenuation coefficient in flight. This quantity is four times smaller than the usual narrow beam attenuation coefficient. Several square miles of a varied underwater landscape were also mapped.
Author

N75-33624# Joint Publications Research Service, Arlington, Va.
ACOUSTIC METHODS AND FACILITIES FOR INVESTIGATING THE OCEAN
26 Sep. 1975 223 p refs Transl. into ENGLISH from Tesizy Dokladov Pervoy Dalnevost Akust. Konf. (Vladivostok), 1-6 Oct. 1974
(JPRS-65760) Avail: NTIS HC $7.25 CSCL 08C

The report contains theses of reports delivered at the First Far Eastern Acoustic Conference held in October 1974 related to the investigation of the sea by acoustic equipment and methods. Author

N75-33625# Royal Aircraft Establishment, Farnborough (England).
SEA WAVE SPECTRA DERIVED FROM AIRBORNE RADIO ALTIMETER MEASUREMENTS
A. C. Machin 10 Dec. 1974 29 p ref
(RAE-TM-GW-1001; BR44879) Avail: NTIS HC $3.75

The results of a preliminary investigation into the accuracy of sea wave spectra derived from measurements of the sea wave encounter spectrum, are presented. The basic measurements require an aircraft equipped with a radio altimeter and tape recorder with some available means of calculating the motions of the aircraft in a vertical plane. The predicted spectra are compared with those derived from wave measurements using a datawell waverider buoy. A FORTRAN program to carry out the processing of results is included. Author (ESA)

N75-33626# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
THE INITIAL WATER CIRCULATION AND WAVES INDUCED BY AN AIRFLOW
W. L. McLeish and G. E. Putland Feb. 1975 51 p refs
(COM-75-10670/8; NOAA-TR-ERL-316-AOML-16; NOAA-75042805) Avail: NTIS HC $4.25; also avail. from SOD as C55.13:ERL-316-AOML-16 CSCL 08C

The early water circulation and waves under an airflow were examined in laboratory experiments. At a particular fetch or time, a waterflow undergoes a laminar-turbulent transition through an intermediate circulation pattern. Simultaneously the first, capillary-gravity waves undergo a correlated characteristic transition leading to separate capillary and gravity waves, and the wave energy increases markedly. Some of the energy of the current is transferred to the waves during the transition. A viscous sublayer lies at the surface above a turbulent flow, but is thinner than a corresponding sublayer at a solid boundary. GRA

N75-33627# Woods Hole Oceanographic Institution, Mass.
CRUISE REPORT, KNORR 8
James E. Gifford Dec. 1974 34 p
(Contract N00014-66-C-0241; NR Proj. 083-004)
(AD-A009838; WHOI-74-102) Avail: NTIS CSCL 08/3

KNORR 8 was a single leg cruise leaving Woods Hole on 11 August and returning on 20 August 1970. The cruise was carried out by the Buoy Project of the Woods Hole Oceanographic Institution. Work consisted of the recovery of three current meter moorings at Site D (39 deg 10 min N, 70 deg 00 min W), the deployment of six bottom moorings on the continental slope, and of two intermediate moorings north and south of the Gulf Stream, the recovery of a surface engineering test at Site L (34 deg N, 70 deg W), and the deployment of a new engineering surface mooring at Site L. Twenty-two CCTD's, three hydro stations, and three plankton tows were also taken. GRA

N75-33628# Woodrow Wilson International Center for Scholars, Washington, D.C.
CRUISE REPORT, ATLANTIS 2-57
James E. Gifford Dec. 1974 23 p
(Contract N00014-66-C-0241; NR Proj. 083-004)
(AD-A009837; WHOI-74-101) Avail: NTIS CSCL 08/3

On May 7, 1970 the R/V ATLANTIS II left Woods Hole on a single-leg cruise for the Institution's Buoy Project, to return on May 21. In addition to servicing the moorings of the Project's continuing moored-arrayed program, other tasks included tests of prototype AMF gear, emplacement of biological samples, hydrographic and CCTD work, and Niskin sampling. Search for portions of moorings earlier reported off station was unsuccessful. GRA

N75-33629# Scripps Institution of Oceanography, La Jolla, Calif.
SURFACE WATER TEMPERATURES AT SHORE STATIONS. UNITED STATES WEST COAST 1973
1 Apr. 1975 24 p
(Contract N00014-69-A-0200-6049; Grant NSF GD-32879)
(AD-A009937; SIO-Ref-75-8) Avail: NTIS CSCL 08/18

This report presents sea surface temperature and salinity data observed during 1973 along the west coast of North America from the straight of Juan de Fuca, Washington to La Jolla, California. The data consist of monthly means, ranges and standard deviations based on daily observations. GRA

N75-33630# Naval Postgraduate School, Monterey, Calif.
A NUMERICAL STUDY OF AN IDEALIZED OCEAN USING NONLINEAR LATERAL EDDY VISCOSITY COEFFICIENTS M.S. Thesis
Julian Maynard Wright, Jr. Mar. 1975 75 p refs
(AD-A009973) Avail: NTIS CSCL 08/3

Using a one level, barotropic ocean model, driven by surface winds, a finite difference form of the vorticity equation was integrated over 210 days of simulated time. The solutions using a constant coefficients of lateral eddy viscosity were compared with those using a variable coefficients derived from enstrophy cascade and energy cascade. Using a constant eddy viscosity coefficient of rather low magnitude produces a large amplitude computational oscillation which fills the entire basin. An order of magnitude larger coefficient produces a marginally satisfactory solution, where the western boundary current was rather well represented, but a moderate computational oscillation was still evident. By increasing the coefficient yet another order of magnitude, the computational oscillation is negligible, but the solution in the ocean interior is unrealistically damped. An accurate physical and numerical depiction of both the ocean interior and western boundary with no computational oscillation was achieved by using either of the two forms of non linear eddy viscosity. GRA

N75-33631# Alaska Univ., College. Inst. of Marine Science.
VARIATIONS IN THE HYDROGRAPHIC STRUCTURE OF PRINCE WILLIAM SOUND
Robin D. Muench and C. Michael Schmidt 1974 137 p refs
(Grant NOAA-04-3-158-75-1)
(COM-75-10729/2; IMS-R75-1; Sea-Grant-75-1;
NOAA-75051406) Avail: NTIS HC $5.75 CSCL 08J

Prince William Sound, a complex fjord-type estuarine system located off the northern Gulf of Alaska, is one of the larger North American estuarine systems not presently influenced by metropolitan activities. The study analyzes and discusses. The physical oceanographic conditions in the Sound are analyzed and discussed, providing information which can be used in making management decisions and planning specific research in the region. Those areas which are studied include the distribution of temperature, salinity, and density; mixing processes and circulation; deep-water renewal processes; and seasonal variations in hydrographic conditions. GRA

N75-33632# Naval Postgraduate School, Monterey, Calif.
SINGLE CHANNEL PREDICTION FOR EARTH TIDAL TILT DATA M.S. Thesis
Chien Wu Chang Mar. 1975 70 p refs
(AD-A010850) Avail: NTIS CSCL 08/11

The earth tidal tilt data consists of two parts: one is the theoretical part caused by the tidal potential of the moon and the sun; another one is the seismic noise part that originates from meteorological, hydrodynamic, and cultural sources. The theoretical part is completely determinable by astronomical data. The seismic noise may be considered as a stationary stochastic process over short periods of time when there have been no great changes in the source mechanisms. Based on the above assumption, prediction and interpolation of the earth tidal tilt data can be achieved by solving the Wiener-Hopf equation. A computer program PREDICT is derived by using Levinson's recursive method to solve the discrete-time Wiener-Hopf equation. Test results on real data are satisfactory. Besides the earth tidal tilt data, the PREDICT program can also be applied to any stationary stochastic discrete-time signal. GRA

N75-33633# Texas Univ., Austin. Applied Research Labs.
STUDIES OF SEDIMENT SHEAR WAVES, ACOUSTICAL IMPEDANCE, AND ENGINEERING PROPERTIES
Donald J. Shirley and Aubrey L. Anderson 7 May 1975 49 p refs
(Contract N00014-70-A-0166-0017)
(AD-A010547; ARL-TR-75-23) Avail: NTIS CSCL 08/10

Compressional wave speed and attenuation have been measured in situ with the ARL/UT compressional wave profilometer. As an extension of this work, studies have been made of the feasibility of measuring shear wave speed and attenuation, as well as sediment bulk density in situ, using similar techniques. Various transducer configurations have been constructed and tested. Preliminary data have been measured using some of the transducers. Concurrent measurements of engineering properties enable comparisons to be made with acoustic properties. Instruments have been contructed to measure several sediment engineering parameters including Atterberg limits and vane shear strength. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N75-33634 New York Univ., N.Y.
PLANKTON COMMUNITIES AT FIRE ISLAND INLET (GREAT SOUTH BAY, LONG ISLAND, NEW YORK) Ph.D. Thesis
Sylvia Short Weaver 1975 148 p
Avail: Univ. Microfilms Order No. 75-22935

Both zooplankton and phytoplankton communities were observed and recorded at Fire Island Inlet from 1971 to 1974. Species typical of a temperate, neritic environment were found. Sampling by net and bottle at several stations in the area revealed two populations, one representative of the Bay water and the other representative of the Ocean water. It was further found that these two populations could be followed from one station (Oak Beach) by sampling at the appropriate tidal intervals, i.e., mid-tide after slack, on both the ebb and flow tides. Observations of plankton communities representative of Bay water and of ocean water as they move into and out of the Inlet from one station could be of significance in monitoring the effects of proposed man made changes in the environment. Dissert. Abstr.

N75-33635*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EFFECT OF STERILIZATION ON BIOLOGICAL, ORGANIC GEOCHEMICAL AND MORPHOLOGICAL INFORMATION IN NATURAL SAMPLES
Lawrence I. Hochstein, Keith A. Kvenvolden, and Delbert E. Philpott Apr. 1974 74 p refs
(NASA-TM-X-72883) Avail: NTIS HC $4.25 CSCL 06C

The loss of biological, organic geochemical, and morphological science information that may occur should a Mars surface sample be sterilized prior to return to earth is examined. Results of experimental studies are summarized. Author

N75-33636*# Transemantics, Inc., Washington, D.C.
EVOLUTION OF CONCEPTS OF THE ORIGIN OF LIFE, 1924 - 1974
A. I. Oparin Washington NASA Oct. 1975 15 p Transl. into ENGLISH of conf. paper from Izv. Akad. Nauk SSSR, Ser. Biol. (USSR), no. 1, Jan.-Feb. 1975 p 5-10 Presented at Intern. Seminar on Origin of Life, Moscow, 2-7 Aug. 1974
(Contract NASw-2792)
(NASA-TT-F-16593) Avail: NTIS HC $3.25 CSCL 06C

Basic changes over the past 50 years in the theory of the evolution of life on earth are outlined. The first concerns the possibility of the abiogenous synthesis of organic matter on earth. Radioastronomic data has indicated that complex and high molecular carbon compounds exist in space. Thus, earth during its early formation inherited a large amount of organic matter. Second, evolution did not proceed in an orderly fashion in only one direction at one time; in various subvital territories on earth, various stages of biopoiesis existed, where deconposition was equally if not more common than synthesis. Thus, the concentrated primordial broth theory must be rejected. Finally, whole separate-phase systems (probations) initially evolved from the high molecular compound water solution. These complex systems then became subject to natural selection, which eventually led to specialization of internal systems and transition from chemical to biological evolution. Author

N75-33637*# Scientific Translation Service, Santa Barbara, Calif.
BACTERIAL RHODOPSIN AS A LIGHT ENERGY CONVERTER
D. Oesterhelt Washington NASA Oct. 1975 12 p refs Transl. into ENGLISH from Nachrichten Aus Chem. und Tech. (West Ger.), v. 22, no. 22, 1974 p 475-476
(Contract NASw-2483)
(NASA-TT-F-16597) Avail: NTIS HC $3.25 CSCL 06M

The structure, function, and energy converting properties of bacteriorhodopsin are analyzed. Bacteriorhodopsin is a complex of retinal and protein which makes up the purple membrane in halophilic bacteria. The membrane serves as a light energy source for the bacteria by pumping protons out of the cell. Author

N75-33638# General Electric Co., Syracuse, N.Y. Electronics Lab.
STUDY AND DEVELOPMENT OF INFUSIBLE AND INCORRODIBLE IDENTIFICATION TAGS AND MICRODOTS
W. T. Gannon Sep. 1974 50 p refs
(Contract DAAG17-72-C-0097; DA Proj. 1J6-62713-DJ-40)
(AD-A010389; USA-NLABS-TR-75-27-CEMEL) Avail: NTIS CSCL 15/5

The program covers the development of a new type of personnel identification tag, conceived by the Army Natick Laboratories, for identifying personnel who have been subjected to cataclysmic events. In particular the tags are to be incorrodible and infusible at 2000 F. The tag is 1 in x 2 in and contains a facial image, fingerprints, and alphanumeric characters. Both chemical and laser etching techniques have been investigated. For use with the ID tag, a cable type nicklace, which will withstand the temperature required but will fail in tension in order to protect the wearer, has been designed. Also, an investigation has been made of microdots, which include the basic features of the tag. Single pulse laser recording, for selective evaporation of a surface deposited on a substrate, is the mechanism investigated. GRA

N75-33639# National Marine Fisheries Service, Seattle, Wash. Southwest Fisheries Center.
PHYTOPLANKTON PIGMENT AND PRODUCTION MEASUREMENTS IN THE CALIFORNIA CURRENT REGION, 1969-72
R. W. Owen, Jr. and C. K. Sanchez Nov. 1974 188 p refs (COM-75-10784/7; NOAA-NMFS-dr-91; NOAA-75-52102) Avail: NTIS HC $7.00 CSCL 06C

Phytoplankton production, standing stocks, and some relevant environmental characteristics were systematically measured in the California Current system during the period from 1969 through 1972. The report describes the systems and methods of measurement along with the data obtained. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N75-33640* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPHTHALMIC LIQUIFACTION PUMP Patent
Edward F. Baehr, Jack B. Esgar, and William J. McGannon, inventors (to NASA) Issued 23 Sep. 1975 17 p Filed 14 Sep. 1973 Supersedes N73-32000 (11 - 23, p 2749)
(NASA-Case-LEW-12051-1; US-Patent-3,906,954; US-Patent-Appl-SN-397478; US-Patent-Class-128-305; US-Patent-Class-128-230) Avail: US Patent Office CSCL 06B

A surgical tissue macerating and removal tool is disclosed wherein a rotating member having a cutting tip is utilized. When the instrument is to be used in an eye, a treatment fluid is supplied to the operative site and a first pump is provided to evacuate macerated material and treatment fluid from the eye. The rotating member may be disposed in a support tube having an aperture and communication with the first pump to provide for discharge of the macerated material and used treatment fluid. A second pump means is provided on the rotating member to provide a counter flow of treatment fluid into the space between the rotating member and the support tube. The second pump may provide additional support for the rotating member. Means is also provided for axially positioning rotating member to increase or decrease cutting action.
Official Gazette of the U.S. Patent Office

N75-33641*# Air Force Academy, Colo. Instrumentation Lab.
ANALYSIS OF CHANGES IN LEG VOLUME PARAMETERS, AND ORTHOSTATIC TOLERANCE IN RESPONSE TO LOWER BODY NEGATIVE PRESSURE DURING 28-DAYS EXPOSURE TO ZERO GRAVITY SKYLAB 2
Richard D. Barnett, Richard J. Gowen, and David R. Carroll Mar. 1975 240 p refs
(NASA Order T-66344-G)
(NASA-CR-141883) Avail: NTIS HC $7.50 CSCL 06S

The design of the leg volume measuring system employed for the M092 portion of the Skylab missions required the development of a system sensitive to large and small volume changes at the calf of the leg. These changes in volume were produced in response to the orthostatic stress of a Lower Body Negative Pressure Device (LBNPD) or by venous occlusion. The cardiovascular responses of the Apollo crewman associated with the postflight evaluations indicate varying decrements of orthostatic tolerance. The postflight changes indicate a slightly diminished ability of the cardiovascular system to function effectively against gravity following exposure to weightlessness. The objective of the Skylab LBNP experiments (M092) was to provide information about the magnitude and time course of the cardiovascular changes associated with prolonged periods of exposure to weightlessness. The equipment, signal processing, and analysis of the leg volume data obtained from the M092 experiment of the Skylab 2 Mission are described. Author

N75-33642*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THERMISTOR HOLDER FOR SKIN TEMPERATURE MEASUREMENTS Patent Application
John E. Greenleaf and Bill A. Williams, inventors (to NASA)

Filed 29 Sep. 1975 12 p
(NASA-Case-ARC-10855-1; US-Patent-Appl-SN-617612) Avail: NTIS HC $3.25 CSCL 06B

An improved thermistor holder structure is disclosed which facilitates skin temperature measurement. The device includes a cylindrical plastic housing with tab extensions that permit the apparatus to be held to a skin surface by suitable elastic members. Ventilation openings are provided in the plastic housing to permit air circulation. An adjustable, resilient metal arm with a thermistor holding cup formed at one end is secured to the interior surface of the plastic housing such that the holding cup is located at the center of the housing. A thermistor temperature sensor is inserted into and held in the cup by interference fit. NASA

N75-33643# McGill Univ., Montreal (Quebec). DRB Aviation Medical Research Unit.
DRB AVIATION MEDICAL RESEARCH UNIT REPORTS, VOLUME 4, 1973-1974
G. Melvill Jones, comp. and G. Mandl, comp. Jun. 1975 270 p refs Sponsored by Defence Res. Board
(DR-223-Vol-4) Avail: NTIS HC $8.50

Basic neural mechanisms implicated in human vestibulo visual perception and sensorimotor performance are elaborated. For individual titles, see N75-33644 through N75-33655.

N75-33644 McGill Univ., Montreal (Quebec).
GOAL-DIRECTED FLEXIBILITY IN THE VESTIBULO-OCULAR REFLEX ARC
G. Melvill Jones and A. Gonshor *In its* DRB Aviation Med. Res. Unit Rept., Vol. 4 Jun. 1975 p 1-20 refs Presented at the Intern. Symp. on Basic Mech. of Ocular Motility and their Clinical Implications, Stockholm Submitted for publication (For availability see N75-33643 24-52)

Functional capabilities and limitations in both the mechanical and neural components of the vestibulo-ocular reflex system are studied by different experimental approaches. A strong implication of vestibular cerebellum participation, in particular the flocculus, in visual modification of the vestibulo-ocular reflex response seems indicated. It is proposed that the cerebellum acts as a major neural source for adaptive control in sensory motor mechanisms. G.G.

N75-33645 McGill Univ., Montreal (Quebec).
ABSENCE OF HABITUATION IN THE HUMAN VESTIBULO-OCULAR REFLEX ARC BY ROTATIONAL STIMULATION WITHIN THE RANGE OF NATURAL MOVEMENT
A. Gonshor and G. Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept. Vol. 4 Jun. 1975 p 21-32 refs (For availability see N75-33643 24-52)

Repeated unidirectional rotational stimulation of the semicircular canals leads to a response decline in the vestibulo ocular reflex termed here habituation. The present objective was to examine the question of whether such habituation would occur as a consequence of repeated periodic rotational stimuli in the range of natural head movement. For this purpose horizontal sinusoidal rotational stimulation of 1/6 Hz and 60 deg/sec angular velocity amplitude was employed since these parameters lie within the presumed angular velocity transducing range of the human semicircular canals. Horizontal eye movements were measured by electrooculography. The results revealed no consistent change in the mean VOR gain (ratio of slow phase eye angular velocity to turntable velocity). It is concluded that these conditions of repeated vestibular stimulation did not induce habituation of the kind to be expected from previous habituation studies. Author

N75-33646 McGill Univ., Montreal (Quebec).
HABITUATION OF THE HUMAN VESTIBULO-OCULAR REFLEX INDUCED BY REVERSAL OF THE RETINAL IMAGE DURING SINUSOIDAL ROTATION OF THE HEAD
G. Melvill Jones and A. Gonshor *In its* DRB Aviation Med. Res. Unit Rept., Vol. 4 Jun. 1975 p 33-46 refs (For availability see N75-33643 24-52)

Mirror habituating trials during human rotational vestibular stimulation tests reversed optikinetic input to the eyes and substantially (25%) declined vestibulo-ocular reflexes in human subjects. It is concluded that the observed habituation induced active opposition to eye movements required for retinal image stabilization. G.G.

N75-33647 McGill Univ., Montreal (Quebec).
PLASTICITY IN THE VESTIBULO-OCULAR REFLEX ARC REVEALED BY LONG-TERM PRISM-REVERSAL OF VISION DURING NATURAL HEAD MOVEMENT
A. Gonshor and G. Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 4 Jun. 1975 p 47-92 refs (For availability see N75-33643 24-52)

Habituation or change in the human vestibulo-ocular reflex in response to long term prism reversal of vision bear out the intimate relationship of the visual and vestibular systems. Response changes are strictly confined to plane of vision reversal and appear to imply reorganization of specific neural networks towards the optimal criterion of minimal retinal image slip during head rotation. Visually evoked changes in the cerebellum constitute a prime factor in the generation of these adaptive changes. G.G.

N75-33648 McGill Univ., Montreal (Quebec).
ADAPTIVE NEUROBIOLOGY IN SPACE FLIGHT
G. Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 4 Jun. 1975 p 93-102 refs Presented at the Skylab Life Sci. Symp., Houston, 27-29 Aug. 1974 (For availability see N75-33643 24-52)

Neurobiological studies conducted in conjunction with Skylab manned space missions clearly revealed adaptive physiological changes in response of the human body to extended weightlessness exposure. None of the measured changes proved irreversible after return to earth. Symptoms ranged from acute disorientation due to sensory illusion to functional implications of the neuromuscular system. G.G.

N75-33649 McGill Univ., Montreal (Quebec).
VESTIBULAR CONTRIBUTIONS TO MOVEMENT CONTROL
G. Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 4 Jun. 1975 p 103-105 refs Presented at the Symp. on Suprasegmental Control of Movement, New Delhi, 20-26 Oct. 1974 Submitted for publication (For availability see N75-33643 24-52)

Basic differences in vestibular stimulus response relations associated with reflex systems driving the extraocular muscles, the neck muscles and the postural muscles of the limbs are considered. It is indicated that the stabilizing role of the vestibular sensory system is supported by the participation of vestibulo-spinal projections in the synthesis of normal locomotor control. G.G.

N75-33650 McGill Univ., Montreal (Quebec).
EIGHTH NERVE CONTRIBUTIONS TO THE SYNTHESIS OF LOCOMOTOR CONTROL
G. Melvill Jones, D. G. D. Watt, and S. Rossignol *In its* DRB Aviation Med. Res. Unit Rept., Vol. 4 Jun. 1975 p 106-120 refs Presented at the Intern. Symp. on Control of Locomotion and Posture, Edmonton, Can., 1973 Submitted for publication (For availability see N75-33643 24-52)

A short latency EMG response was demonstrated (75 msec) in human gastrocnemius on sudden unexpected initiation of a free fall pointing to a functionally effective vestibulo-spinal response to specifically vertical linear accelerative stimulation of the vestibular otolith end organs. Since large cyclical changes in vertical linear acceleration of the head occur during normal human locomotion, especially running, it seems likely that this specific vestibulo-spinal influence could play an important role in the synthesis of normal locomotor control. This question has been examined in human subjects using hopping on one leg as a simplified monopedal model of cyclical locomotor activity. Author

N75-33651 McGill Univ., Montreal (Quebec).
THE INFLUENCE OF AUDITORY STIMULI ON THE H-REFLEX IN MAN
S. Rossignol and G. Melvill Jones *In its* DRB Aviation Med. Res. Unit Rept., Vol. 4 Jun. 1975 p 164-190 refs (For availability see N75-33643 24-52)

The time course of the subliminal effect of a short tone burst at the spinal motoneuron level in man was studied by the *H* reflex technique. Various changes in excitability of motoneurons after a tone burst are discussed. It is inferred that a audio spinal influence may participate in the control of rhythmical movements in synchrony with auditory stimuli. Author

N75-33652 McGill Univ., Montreal (Quebec).
DOES AUDIOSPINAL FACILITATION CONTRIBUTE TO MOTOR CONTROL IN DANCE RESPONSE TO MUSICAL RHYTHMS?
G. Melvill Jones and S. Rossignol *In its* DRB Aviation Med. Res. Unit Rept., Vol. 4 Jun. 1975 p 191-212 refs (For availability see N75-33643 24-52)

A temporal relationship is established between muscular and auditory events in subjects hopping on one leg at the preferred frequency and synchrony with a sequence of muscle. Various neurological, mechanical and metabolic characteristics involved in the setting up of the preferred frequency of hopping are discussed and a hypothesis concerning the possible effect of music on stereotyped movements is developed. Author

N75-33653 McGill Univ., Montreal (Quebec).
AUDITORY STARTLE RESPONSES RECORDED IN THE LEG OF MAN
S. Rossignol *In its* DRB Aviation Med. Res. Unit Rept., Vol. 4 Jun. 1975 p 213-233 refs (For availability see N75-33643 24-52)

Electromyographic recordings of startle responses of the human ankle to high intensity tone bursts show inhibitory phenomena attributed to a reticulo spinal input mechanism. Indications seem to link competing facilatory and inhibitory reticulo spinal influences to differing levels of stimulus intensities. Author

N75-33654 McGill Univ., Montreal (Quebec).
THE LATE ELECTROMYOGRAPHIC RESPONSE TO MUSCLE STRETCH IN MAN
C. W. Y. Chan *In its* DRB Aviation Med. Res. Unit Rept., Vol. 4 Jun. 1975 p 234-251 refs (For availability see N75-33643 24-52)

Gastrocnemius functional stress reflex latency was studied for variations in the length and velocity of muscle stretch and initial muscle tension. Data on amplitude of ankle angle, angular velocity, and initial torque generated at the ankle showed that functional stress reflex bears a close correlation with the amplitude of dorsoflexion, its latency decreasing with increasing amplitude of stretch. The response was also very sensitive to the initial force generated at the ankle prior to stimulus application. It is concluded that the functional stress reflex is a length dependent response, and that secondary endings of the muscle spindle which signal muscle length are implicated as prime contributors. Author

N75-33655 McGill Univ., Montreal (Quebec).
THE BRAIN IN OUR RAPIDLY CHANGING ENVIRONMENT: ADAPTABLE MAN?
D. Guitton *In its* DRB Aviation Med. Res. Unit Rept., Vol. 4 Jun. 1975 p 252-264 refs Presented at the World Man Fund Congr., Moltraiso, Italy, Sep. 1974 (For availability see N75-33643 24-52)

Human adaptation experiments that require a new coordination between sensory input and motor activity indicate a stressful reorganization of neural systems by the brain. Restructuring of the internally generated template which compares what the brain believes should happen with what actually happens is a lengthy process that never may reach optimum criteria. G.G.

N75-33656*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
PROGESTERONE AND TESTOSTERONE BINDING IN HUMAN ENDOMETRIUM DURING PREGNANCY
N. A. Yudayev and M. K. Asribekova Washington NASA Sep. 1975 10 p refs Transl. into ENGLISH from Probl. Endokrinol. i Gormonoterap. (Moscow), v. 20, no. 2, Mar.-Apr. 1974 p 24-28
(Contract NASw-2789)
(NASA-TT-F-16546) Avail: NTIS HC $3.25 CSCL 06A

Progesterone-H3 incubated with a soluble fraction of endometrium of a pregnant woman formed a complex with protein with a sedimentation coefficient of 6.3S and 3.5S; under identical conditions testosterone-H3 formed a complex with a sedimentation coefficient of 7.5S and 3.5S. The specificity of steroid receptors was determined by the method of competent binding of hormones with proteins. Author

N75-33657*# Kanner (Leo) Associates, Redwood City, Calif.
COMPARATIVE ASPECTS OF PHOTORECEPTION OF RETINAL PROTEIN COMPLEXES
D. Oesterhelt Washington NASA Oct. 1975 25 p refs Transl. into ENGLISH of conf. paper from Mosbacher Colloq. der Ges. fuer Biol. Chem. (Berlin), 1974 p 55-77
(Contract NASw-2790)
(NASA-TT-F-16606) Avail: NTIS HC $3.25 CSCL 06P

The differences and shared properties of three types of retinal-protein complexes are discussed. These complexes are: visual pigments, retinochromes, and bacteriorhodopsin. It is shown that: (1) visual pigments have a binding site for 11-cis-retinal and 9-cis-retinal, while retinochrome and bacteriorhodopsin have a binding site for 13-cis-retinal and all trans-retinal; (2) when the resulting the chromosphore absorbs light, all retinal-protein complexes undergo cis-trans isomerizations of their retinal section and conformational changes in their protein section; (3) bacteriorhodopsin regenerates its initial state in a spontaneous, temperature dependent, dark reaction; and (4) in the presence of light, visual pigments have a signal giving function, retinochrome a catalytic function, and bacteriorhodopsin an energy-transforming function. Author

N75-33658*# Scientific Translation Service, Santa Barbara, Calif.
VARIATION OF INTRACARDIAC AND INTRAVASCULAR TEMPERATURE IN MAN
Mamoru Kawakami Washington NASA Oct. 1975 19 p refs Transl. into ENGLISH of Japan Circulation J. (Kyoto), v. 36, Aug. 1972 p 905-914
(Contract NASw-2791)
(NASA-TT-F-16598) Avail: NTIS HC $3.25 CSCL 06P

Studies are performed to determine what types of temperature slopes exist in the heart and intravascular space in humans and what temperature variations exist at the sites where measurements are taken. It is found that intracardiac and intravascular temperatures are not constant. Author

N75-33659*# Kanner (Leo) Associates, Redwood City, Calif.
IMMUNE BACTERICIDAL AND BACTERIOLYTIC REACTIONS
R. Audran Washington NASA Oct. 1975 53 p refs Transl. into ENGLISH from Rev. Franc. de Transfusion (France), v. 15, no. 1, 1972 p 81-137
(Contract NASw-2790)
(NASA-TT-F-16599) Avail: NTIS HC $4.25 CSCL 06A

The lethal action of the antibody-complement system is examined along with the potential effect of Lysozyne. It is indicated that increased susceptibility to infection is associated with antibody deficiency, and exceptionally with deficiency in complement. Immunoconglutinin is believed to enhance the in vivo activity of antibody and complement in bactericidal activity. Author

N75-33660# Civil Aeromedical Inst., Oklahoma City, Okla.
ANTHROPOMETRY OF AIRLINE STEWARDESSES
Clyde C. Snow, Herbert M. Reynolds, and Mackie A. Allgood Mar. 1975 106 p refs
(AD-A012965/0; FAA-AM-75-2) Avail: NTIS HC $5.25 CSCL 06/16

This report presents the body measurements of 423 stewardess trainees enrolled in the American Airlines Stewardess Training Academy in Fort Worth, Texas, between February and June 1971. It includes the means, standard deviations, coefficients of variation, percentiles, and related statistics of 72 standard anthropometric and functional measurements. The survey was initiated to provide adequate criteria for improving the emergency equipment availability and workspace design for stewardesses. Author

N75-33661# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
DRUG EFFECTS ON HEART RATE AND HEART RATE VARIABILITY DURING A PROLONGED REACTION TASK
A. W. K. Gaillard, D. A. Trumbo, and A. J. Kruf 1975 24 p refs Partly sponsored by Natl. Steering Comm. Brain and Behaviour
(Contract A72/K/070)
(IZF-1975-3; TDCK-65965) Avail: NTIS HC $3.25

The effects of an amphetamine and a barbiturate on heart

rate were investigated during long term performance (three hours in a serial reaction task). Besides the interbeat interval (IBI) derived from the successive R-tops of the ECG, the variability of IBI was scored in three ways. Each of the four scores increased as a function of time on the task, indicating a gradually decreasing activation level during the three hour session. The amphetamine had an activating effect, decreasing both IBI and IBI variability; the barbiturate, on the other hand, tended to increase IBI variability but decrease IBI. IBI changes between constant and variable blocks were negligible after amphetamine treatment, but pronounced after barbiturate treatment. IBI variability was reduced during blocks with variable interstimulus intervals, where mental effort was assumed to be maximal. This reaction was more pronounced for the amphetamine than the barbiturate. Author (ESA)

N75-33662# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

ACTH 4-10 AND LEARNING

A. F. Sanders, C. L. Truijens, and A. A. Bunt 1975 20 p refs Sponsored by N. V. Organon

(IZF-1975-4; TDCK-66363) Avail: NTIS HC $3.25

Three experiments on the effects of ACTH 4-10 on the processes of learning and retention are described. The first study concerns a paired associate learning and retention experiment. The results show no effect of ACTH 4-10 on either speed of learning or interference in comparison with the placebo. In the second study, on learning a functional rule, ACTH 4-10 was found to have a beneficial effect in particular on learning a more difficult rule. A final experiment on immediate retention of digits strings do not show any differences between test persons treated with ACTH 4-10, and those who received a placebo. There is no theoretical framework to explain these divergent results and it is proposed to repeat and extend the rule learning study before developing any theory. Author (ESA)

N75-33663# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).

SOME REACTIONS OF THE HYDROXYL ADDUCT OF ADENINE

J. J. VanHemmen 1975 12 p refs Sponsored by Neth. Organ. for the Advan. of Pure Res. (ZWO)

(MBL-1975-8; TDCK-65963) Avail: NTIS HC $3.25

The chemical reactions of purine derivatives resulting from pulse radiolysis were studied. Some reactions of the hydroxyl adduct of adenine are described and one of these reactions was compared with similar reactions of hydroxyl adducts of other purine derivatives. Evidence is given that in various purines opening of the imidazole ring is due to unimolecular rearrangements of the hydroxyl adducts. ESA

N75-33664# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).

INACTIVATION OF BIOLOGICALLY ACTIVE DNA BY GAMMA RAY INDUCED SUPEROXIDE RADICALS AND THEIR DISMUTATION PRODUCTS SINGLET MOLECULAR OXYGEN AND HYDROGEN PEROXIDE

J. J. VanHemmen and W. J. A. Meuling 1975 23 p refs

(MBL-1975-10; TDCK-66036) Avail: NTIS HC $3.25

The reactivity of gamma ray induced superoxide radicals and dismutation products (singlet molecular oxygen and hydrogen peroxide) with DNA were studied. Superoxide dismutase, which removes superoxide radicals and inhibits the formation of singlet oxygen, protects biologically active DNA (OX174 RF) against inactivation by ionizing radiation. Catalase, which removes hydrogen peroxide, also protects the DNA. Attempts with various chemical sources of singlet oxygen to determine whether this species inactivates DNA did not yield an unequivocal answer. It was concluded that a combination of the protonated form of the superoxide radical and hydrogen peroxide inactivates DNA. Author (ESA)

N75-33665# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).

COMPARISON OF THE OXYGEN ENHANCEMENT RATIO FOR GAMMA RAY INDUCED DOUBLE-STRAND BREAKS IN THE DNA OF BACTERIOPHAGE T7 AS DETERMINED BY TWO DIFFERENT METHODS OF ANALYSIS

G. P. VanDerSchans and A. C. M. VanDerDrift 1975 20 p refs

(MBL-1975-11; TDCK-66035) Avail: NTIS HC $3.25

The influence of oxygen on the rupture of the double-strand DNA molecule in the T7 bacteriophage caused by gamma radiation was investigated. The bacteriophage was irradiated with gamma rays from Cobalt-60 in a protecting medium under nitrogen and oxygen. Double-strand breaks were measured by sucrose gradient sedimentation and by boundary sedimentation analysis. Both methods showed that the presence of oxygen during irradiation enhances the production of double-strand breaks. This is in contrast to a recent report which suggests that boundary sedimentation analysis does not exhibit any effect from oxygen. The discrepancy must be ascribed to differences in interpretation of the sedimentation data. Author (ESA)

N75-33666# Hazleton Labs. America, Inc., Vienna, Va.

EFFECTS OF INHALING SULFUR DIOXIDE, SULFURIC ACID, AND FLY ASH

Apr. 1975 70 p refs Sponsored by the Elec. Power Res. Inst. and the Tenn. Valley Authority

(PB-241788/9; EPRI-RP74) Avail: NTIS HC $4.25 CSCL 06F

The physiological effects of the inhalation of three air pollutants in cynomolgus monkeys and guinea pigs are studied. Exposures were conducted 24 hours per day, seven days a week for three 78-week phases in monkeys and four 52-week phases in guinea pigs. The pollutants examined, singly and in binary and ternary combinations were one gas, sulfur dioxide, sulfuric acid mist, and fly ash. The nominal exposure levels selected were 0.1, 0.5, 1.0, and 5.0 ppm for SO2, 0.1 and 1.0 mg/cubic meters for H2SO4, and 0.1 and 0.5 mg/cubic meters for fly ash. Nominal particle sizes selected were less than one micron, and one to five microns for H2SO4, and less than five microns for fly ash. GRA

N75-33667# Union Carbide Corp., Tarrytown, N.Y. Corporate Research Lab.

IN VIVO BUBBLE GROWTH STUDIES FOLLOWING DECOMPRESSION

Michael Robert Powell and Karl J. Weydig 16 Dec. 1974 30 p refs

(Contract N00014-74-C-0415)

(AD-A009963; CRL-T-798) Avail: NTIS CSCL 06/16

In this series of investigations on the in vivo growth of a gas phase following decompression, the authors removed sections of skeletal muscle tissue following decompression and quickly placed them between two glass plates. Histological procedures were not employed as the gas phase was found to vanish quickly, and therefore untreated whole mounts were employed. Studies indicated that (1) bubbles were not found to originate in the capillaries but rather in venules; (2) a cylindrical, rather than a spherical, gas phase was found in the microvasculature; (3) few extravascular bubbles were ever seen, even in adipose tissue; (4) bubbles could be found more easily in adipose than muscle tissue; (5) bubbles were not found to coalesce in venules; (6) when the gas phase was seen to resolve in the tissue slices, the capillaries lost gas first, then the venules; (7) the gas phase caused a great distension of the capillary walls; (8) bubbles could not be found in peripheral nerve tracts although they could be found in the microvasculature associated with the nerve. GRA

N75-33668# Yale Univ., New Haven, Conn. School of Medicine.

AN EVALUATION OF POLICY RELATED RESEARCH ON NEW AND EXPANDED ROLES OF HEALTH WORKERS. ANNOTATED BIBLIOGRAPHY

Eva D. Cohen, Kathleen Keenan, Linda M. Crootof, Beverly S. Greenberg, and Mieko M. Korper Oct. 1974 168 p refs

(Grant NSF APR73-07902)

(PB-242283/0; NSF/RA/S-74-015A) Avail: NTIS HC $6.25 CSCL 06E

The annotated bibliography includes a selection of evaluations of research on the quality, quantity, and nature of services provided by new types of health personnel, such as nurse practitioners and physician's assistants. Additional topics covered are the acceptance by providers and consumers, as well as the costs

and legal issues associated with the training and use of new health practitioners in the health services system. A separate project report provides a summary of the studies by subject areas. GRA

N75-33669# Nuclear Regulatory Commission, Washington, D.C.
OCCUPATIONAL RADIATION EXPOSURE AT LIGHT WATER COOLED POWER REACTORS, 1969 - 1974
Jun. 1975 21 p refs Supersedes WASH-1311
(PB-242532/0; NUREG-75/032; WASH-1311) Avail: NTIS HC $3.25 CSCL 06J

Occupational radiation exposures at commercial light-water-cooled power reactors (LWR'S) for the years 1969 through 1974 are given. The information is derived from reports submitted to the United States Nuclear Regulatory Commission in accordance with requirements of individual plant Technical Specifications. The average man-rem per unit for all LWR's in 1974 is less than the 1973 value. The grand average since 1969, however, continues to increase. No significant trend was indicated over the period of 1969-1974 in the mean value of man-rem per megawatt-year. GRA

N75-33670# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Mechanical and Industrial Engineering.
THREE-DIMENSIONAL HUMAN DISPLAY MODEL Technical Report, Feb. 1974 - Jul. 1975
Tom E. Potter and Kenneth Willmert Jul. 1975 48 p refs
(Contract N00014-70-A-0311-0003)
(AD-A011097; MIE-010) Avail: NTIS CSCL 06/19

A two-dimensional computer graphic display of a three-dimensional human model has been developed. The major body segments of the model are represented as non-uniform elliptic cylinders. The shadow outlines of these cylinders are displayed on the terminal screen and connected by circular arcs and straight lines to produce a realistic representation of a human being in any position. The human model was developed for the display of results of three-dimensional simulation programs which calculate the position of an occupant during vehicle impact. However, it is well suited to any other type of human motion. It allows the user to select the viewing orientation and was designed for low cost computer and graphic terminal systems. GRA

N75-33106* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
DEVELOPMENT OF A BONE-FIXATION PROSTHETIC ATTACHMENT
Lester J. Owens *In its* 9th Aerospace Mech. Symp. 1974 13 p (For availability see N75-33086 24-12)
CSCL 06B

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N75-33671# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
PRACTICAL PROBLEMS IN USING HUMAN OPERATOR PERFORMANCE DATA
Clyde R. Replogle, C. N. Day, F. M. Holden, and D. B. Rogers Jul. 1973 5 p Presented at the Interagency Conf. on Management and Technol. in the Crew System Design Process, Los Angeles, 12-14 Sep. 1972
(AF Proj. 7222)
(AD-A011574; AMRL-TR-72-84) Avail: NTIS CSCL 05/10

During the past two years, human performance has been investigated within two generic system contexts--manually controlled antiaircraft artillery against high performance aircraft and air-to-air combat in air superiority fighters. The broad objective of this research was to assess the effectiveness of proposed air weapon systems, combat strategies, and countermeasures techniques. In meeting these objectives, it was necessary to address many problems associated with the use of human operator performance data. This paper describes six problem areas considered relevant for this workshop: system versus operator effectiveness, performance feedback, attrition modeling, stress tolerance, human operator identification, and system simulation. GRA

N75-33672# Arizona State Univ., Tempe. Dept. of Educational Technology.
SYSTEMATIC VARIATIONS OF INSTRUCTIONAL VARIABLES ON LEARNER PERFORMANCE: AIRCRAFT INSTRUMENT COMPREHENSION TASK Final Report, Jun. 1973 - Jul. 1974
Barbara G. Tenpas, Robert A. Reiser, Donald R. Kearns, George E. Booth, and Ann E. Deden Dec. 1974 51 p refs
(Contract F41609-71-C-0027; AF Proj. 1123)
(AD-A010106; AFHRL-TR-74-105) Avail: NTIS CSCL 05/9

Incentive, practice, instruction, and feedback were manipulated in a series of four 2 x 2 factorial studies, with AFROTC cadets and graduate students in education, to determine the individual and combined effects of these variables on learner performance of an aircraft instrument comprehensive task. Results are discussed in terms of instruction, as the variable of singular importance in designing materials and procedures to facilitate desired learning outcomes. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N75-33673*# Boeing Aerospace Co., Houston, Tex. Saturn/Apollo/Skylab Branch.
CREW APPLIANCE COMPUTER PROGRAM MANUAL, VOLUME 1
D. J. Russell 29 Aug. 1975 331 p refs
(Contract NAS9-13965)
(NASA-CR-144450; D2-118571-1-Vol-1) Avail: NTIS HC $9.50 CSCL 05H

Trade studies of numerous appliance concepts for advanced spacecraft galley, personal hygiene, housekeeping, and other areas were made to determine which best satisfy the space shuttle orbiter and modular space station mission requirements. Analytical models of selected appliance concepts not currently included in the G-189A Generalized Environmental/Thermal Control and Life Support Systems (ETCLSS) Computer Program subroutine library were developed. The new appliance subroutines are given along with complete analytical model descriptions, solution methods, user's input instructions, and validation run results. The appliance components modeled were integrated with G-189A ETCLSS models for shuttle orbiter and modular space station, and results from computer runs of these systems are presented. Author

N75-33674*# Boeing Aerospace Co., Houston, Tex. Saturn/Apollo/Skylab Branch.
CREW APPLIANCE COMPUTER PROGRAM MANUAL, VOLUME 2
D. J. Russell 29 Aug. 1975 246 p refs
(Contract NAS9-13965)
(NASA-CR-144451; D2-118571-2-Vol-2) Avail: NTIS HC $7.50 CSCL 05H

For abstract, see N75-33673.

N75-33675*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ELEVENTH ANNUAL CONFERENCE ON MANUAL CONTROL
May 1975 719 p refs Conf. held at Moffett Field, Calif., 21-23 May 1975
(NASA-TM-X-62464; A-6211) Avail: NTIS HC $17.25 CSCL 05H

Human operator performance and servomechanism analyses for manual vehicle control tasks are studied. For individual titles, see N75-33676 through N75-33719.

N75-33676* Institut fuer Informationsverarbeitung in Technik und Biologie, Karlsruhe (West Germany).

MULTIVARIABLE MANUAL CONTROL WITH SIMULTANEOUS VISUAL AND AUDITORY PRESENTATION OF INFORMATION

Hartmut Uhlemann and Georg Geiser *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 3-18 refs (For availability see N75-33675 24-54)

CSCL 05H

Multivariable manual compensatory tracking experiments were carried out in order to determine typical strategies of the human operator and conditions for improvement of his performance if one of the visual displays of the tracking errors is supplemented by an auditory feedback. Because the tracking error of the system which is only visually displayed is found to decrease, but not in general that of the auditorally supported system, it was concluded that the auditory feedback unloads the visual system of the operator who can then concentrate on the remaining exclusively visual displays. Author

N75-33677* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXPERIMENTS IN PILOT DECISION-MAKING DURING SIMULATED LOW VISIBILITY APPROACHES

Renwick E. Curry (MIT), John K. Lauber, and Charles E. Billings *In its* 11th Ann. Conf. on Manual Control May 1975 p 19-32 ref (For availability see N75-33675 24-54)

CSCL 05H

A simulation task is reported which incorporates both kinds of variables, informational and psychological, to successfully study pilot decision making behavior in the laboratory. Preliminary experiments in the measurement of decisions and the inducement of stress in simulated low visibility approaches are described. Author

N75-33678* Illinois Univ., Urbana.

TRACKING PERFORMANCE UNDER TIME SHARING CONDITIONS WITH A DIGIT PROCESSING TASK: A FEEDBACK CONTROL THEORY ANALYSIS

Daniel Gopher and Christopher D. Wickens *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 33-63 refs (For availability see N75-33675 24-54)

(Contract F44620-70-C-0105)

CSCL 05H

A one dimensional compensatory tracking task and a digit processing reaction time task were combined in a three phase experiment designed to investigate tracking performance in time sharing. Adaptive techniques, elaborate feedback devices, and on line standardization procedures were used to adjust task difficulty to the ability of each individual subject and manipulate time sharing demands. Feedback control analysis techniques were employed in the description of tracking performance. The experimental results show that when the dynamics of a system are constrained, in such a manner that man machine system stability is no longer a major concern of the operator, he tends to adopt a first order control describing function, even with tracking systems of higher order. Attention diversion to a concurrent task leads to an increase in remnant level, or nonlinear power. This decrease in linearity is reflected both in the output magnitude spectra of the subjects, and in the linear fit of the amplitude ratio functions. Author

N75-33679* California Univ., Berkeley.

TIME ESTIMATION AS A SECONDARY TASK TO MEASURE WORKLOAD

Sandra G. Hart *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 64-77 refs (For availability see N75-33675 24-54)

(Grant NCA2-OR-050-503)

CSCL 05H

Variation in the length of time productions and verbal estimates of duration was investigated to determine the influence of concurrent activity on operator time perception. The length of 10-, 20-, and 30-sec intervals produced while performing six different compensatory tracking tasks was significantly longer, 23% on the average, than those produced while performing no other task. Verbal estimates of session duration, taken at the end of each of 27 experimental sessions, reflected a parallel increase in subjective underestimation of the passage of time as the difficulty of the task performed increased. These data suggest that estimates of duration made while performing a manual control task provide stable and sensitive measures of the workload imposed by the primary task, with minimal interference. Author

N75-33680* Massachusetts Inst. of Tech., Cambridge. Man Vehicle Lab.

FAILURE DETECTION BY PILOTS DURING AUTOMATIC LANDING: MODELS AND EXPERIMENTS

Eli G. Gai and R. E. Curry *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 78-93 refs (For availability see N75-33675 24-54)

(Grant NGR-22-009-733)

CSCL 05H

A model of the pilot as a monitor of instrument failures during automatic landing is proposed. The failure detection model consists of two stages: a linear estimator (Kalman Filter) and a decision mechanism which is based on sequential analysis. The filter equations are derived from a simplified version of the linearized dynamics of the airplane and the control loop. The perceptual observation noise is modelled to include the effects of the partition of attention among the several instruments. The final result is a simple model consisting of a high pass filter to produce the observation residuals, and a decision function which is a pure integration of the residuals minus a bias term. The dynamics of a Boeing 707 were used to simulate the fully coupled final approach in a fixed base simulator which also included failures in the airspeed, glideslope, and localizer indicators. Subjects monitored the approaches and detected the failures; their performance was compared with the predictions of the model with good agreement between the experimental data and the model. Author

N75-33681* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

HUMAN FACTORS RESEARCH PROBLEMS IN ELECTRONIC VOICE WARNING SYSTEM DESIGN

C. A. Simpson and D. H. Williams *In its* 11th Ann. Conf. on Manual Control May 1975 p 94-106 refs (For availability see N75-33675 24-54)

CSCL 05H

The speech messages issued by voice warning systems must be carefully designed in accordance with general principles of human decision making processes, human speech comprehension, and the conditions in which the warnings can occur. The operator's effectiveness must not be degraded by messages that are either inappropriate or difficult to comprehend. Important experimental variables include message content, linguistic redundancy, signal/noise ratio, interference with concurrent tasks, and listener expectations generated by the pragmatic or real world context in which the messages are presented. Author

N75-33682* Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

A DECISION AND CONTROL MULTI-AXIS PILOT MODEL BASED ON AN URGENCY FOR ACTION CONCEPT

J. J. Pollard and R. A. Hannen (Wright State Univ.) *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1974 p 107-118 refs (For availability see N75-33675 24-54)

CSCL 05H

An all digital multiple axis, multiple input, multiple output pilot model flies five different tasks in aircraft of different classes while encountering turbulence represented by the Dryden spectral model. Six degree of freedom linearized aircraft equations of motion are used together with a generalized stability augmentation system. The pilot model consists of two parts: (1) a decision maker, and (2) a control action implementer. This decision maker selects the critical variable and predicts the error at action implementation. The control action implementer decides the magnitude of control to be applied and applies it. This system has been successfully compared with hybrid/analog man in the loop simulations of the F-5, A-7, T-33, and 707 aircraft, thus validating the all digital simulation and the decision and control pilot model. Author

N75-33683* Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

DISCRETE TIME MODELIZATION OF HUMAN PILOT BEHAVIOR

Daniel Cavalli and Dominique Soulatges *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 119-129 refs (For availability see N75-33675 24-54)

CSCL 05H

This modelization starts from the following hypotheses: pilot's behavior is a time discrete process, he can perform only one task at a time and his operating mode depends on the considered flight subphase. Pilot's behavior was observed using an electro oculometer and a simulator cockpit. A FORTRAN program has been elaborated using two strategies. The first one is a Markovian process in which the successive instrument readings are governed by a matrix of conditional probabilities. In the second one, strategy is an heuristic process and the concepts of mental load and performance are described. The results of the two aspects have been compared with simulation data.

Author

N75-33684* Illinois Univ., Urbana. Dept. of Mechanical and Industrial Engineering.

HUMAN INTERACTION WITH AN INTELLIGENT COMPUTER IN MULTI-TASK SITUATIONS

William B. Rouse *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 130-143 refs (For availability see N75-33675 24-54)

(Contract F33615-73-C-1238)

CSCL 05H

A general formulation of human decision making in multiple task situations is presented. It includes a description of the state, event, and action space in which the multiple task supervisor operates. A specific application to a failure detection and correction situation is discussed and results of a simulation experiment presented. Issues considered include static vs. dynamic allocation of responsibility and competitive vs. cooperative intelligence.

Author

N75-33685* Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.

A MODEL FOR SIMULTANEOUS MONITORING AND CONTROL

Renwick E. Curry, David L. Kleinman (Conn. Univ.), and William C. Hoffman (Aerospace Systems, Inc.) *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 144-150 refs (For availability see N75-33675 24-54)

(Contract NAS1-13653)

CSCL 05H

Mathematical models of the human operator have been concerned primarily with his input/output characteristics and his adaptive behavior to sudden changes in the controlled element dynamics. Newer models have examined the ability of the human to detect failures when acting as a monitor. However, models for simultaneous monitoring and control (e.g., an aircraft pilot flying a split axis approach) are necessary for performing pilot task allocations and for coordinated design of display and control subsystems. Flight test results of simulated instrument helicopter approaches conducted have shown the following: (1) constant speed approaches can be made quite comfortably by the pilots; (2) pilots cannot hover on situation displays alone; and (3) pilots can hover with a flight director display, but feel uncomfortable because they do not have enough time to monitor the situation displays.

Author

N75-33686* Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.

DETECTION OF SYSTEM FAILURES IN MULTI-AXES TASKS

Arye R. Ephrath *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 151-169 refs (For availability see N75-33675 24-54)

CSCL 05H

The effects of the pilot's participation mode in the control task on his workload level and failure detection performance were examined considering a low visibility landing approach. It is found that the participation mode had a strong effect on the pilot's workload, the induced workload being lowest when the pilot acted as a monitoring element during a coupled approach and highest when the pilot was an active element in the control loop. The effects of workload and participation mode on failure detection were separated. The participation mode was shown to have a dominant effect on the failure detection performance, with a failure in a monitored (coupled) axis being detected significantly faster than a comparable failure in a manually controlled axis.

Author

N75-33687* New Mexico State Univ., University Park.

RECOGNITION OF STIMULUS DISPLAYS: AN ELECTROPHYSIOLOGICAL ANALYSIS

Victor S. Johnston *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 173-178 refs (For availability see N75-33675 24-54)

CSCL 05H

Late components of evoked waveforms recorded from the frontal areas of the brain are correlated with an observer's interpretation of a stimulus display. The possible use of such signals as control inputs is discussed.

Author

N75-33688* California Univ., Los Angeles. Biotechnology Lab.

FREQUENCY MODULATED CUTANEOUS ORIENTATION FEEDBACK FROM ARTIFICIAL ARMS c45

Moshe Solomonow, Amos Freedy, and John Lyman *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 180-191 refs (For availability see N75-33675 24-54)

(Contract V-101-(134)P121)

CSCL 05H

A model of the human arm, emphasizing the neuromuscular mechanisms of feedback control, has been constructed. The various parameters and functions of physiological receptors in the feedback section have been classified into an automated category that can be incorporated in the prosthesis servo loop, and into a sensory category that should be communicated to the operator if control and dynamic performance are to be optimized. A scheme for simultaneous display of two such sensory parameters, i.e., fingertip pressure and elbow position, has been developed, implemented and evaluated. The neurophysiological mechanism of such displays, and the feasibility of sensory transformation, is discussed in this paper.

Author

N75-33689* Rush Medical Coll., Chicago, Ill. Dept. of Biomedical Engineering.

ROLE OF STRETCH REFLEX IN VOLUNTARY MOVEMENTS

Gerald L. Gottlieb and Gyan C. Agarwal (Ill. Univ., Chicago) *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 192-203 refs (For availability see N75-33675 24-54)

(Grants NSF GK-37540; RR-05477)

CSCL 05H

The stretch reflex is often described as a spinal servomechanism, a device for assisting in the regulation of muscle length. Observation of the EMG response to mechanical interruption of voluntary movements fails to demonstrate a significant role for spinal reflexes at 40 msec latency. Two functional responses with latencies of 120 msec and 200 msec, implying supraspinal mediation, are observed.

Author

N75-33690* Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.

HEAD-EYE TRACKING IN TWO-DIMENSIONAL PURSUIT TASKS

D. K. Shirachi and J. H. Black, Jr. *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 204-216 refs (For availability see N75-33675 24-54)

CSCL 05E

The neurological control systems for the eye and head are studied by investigating dynamic eye and head rotations in two degrees of freedom using bandlimited, white noise stimuli, nominally wide field of view stimulus presentations of + or - 10 deg and power spectral analysis of the data to produce input/output transfer and coherence functions. Determined were frequency response characteristics of these systems, the linearity of the transfer functions in both coupled and decoupled vertical and horizontal stimulus/response reference axes and the amount

of cross axis coupling present in system responses. A comparative study was also conducted to assess the differences in response characteristics between single axis and dual axis visual stimulation for the same subject. Author

N75-33691* Illinois Univ., Chicago.
EFFECTS OF LOW FREQUENCY VIBRATION OF A LIMB
Gyan C. Agarwal (Rush-Presbyterian-St. Luke's Med. Center) and Gerald L. Gottlieb (Rush-Presbyterian-St. Luke's Med. Center) *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 217-242 refs (For availability see N75-33675 24-54)
(Grants NSF GK-37540; RR-05477)
CSCL 05H

Low frequency oscillations were applied on the ankle joint in plantarflexion/dorsiflexion rotation using a torque motor. The torque, the angular rotation and the evoked electromyogram from the gastronemius soleus and the anterior tibial muscles were recorded. Significant nonlinearities were observed in the angular rotation from 8 to 12 Hz. The following methods are used for data analysis: (1) Two cycle averaged response; (2) Fourier transform; and (3) Fourier analysis at the driving frequency. Important observations are: (1) resonance near 6 to 8 Hz; (2) slowly increasing amplitudes of oscillation near resonance; (3) self sustaining oscillations after the motor is turned off, particularly in the fatigued limb; and (4) distortion of angular rotation during which there are spontaneous recurrences of oscillation at the driving frequency. Author

N75-33692* Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
MANUAL CONTROL DISPLAYS FOR A FOUR-DIMENSIONAL LANDING APPROACH
James T. Silverthorn and Robert L. Swaim *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 245-267 refs (For availability see N75-33675 24-54)
CSCL 05H

Six instrument rated pilots flew a STOL fixed base simulator to study the effectiveness of three displays for a four dimensional approach. The three examined displays were a digital readout of forward position error, a digital speed command, and an analog display showing forward position error and error prediction. A flight director was used in all conditions. All test runs were for a typical four dimensional approach in moderate turbulence that invluded a change in commanded ground speed, a change in flight path angle, and two standard rate sixty degree turns. Use of the digital forward position error display resulted in large overshoot in the forward position error. Some type of lead (rate or prediction information) was shown to be needed. The best overall performance was obtained using the speed command display. It was demonstrated that curved approaches can be flown with relative ease. Author

N75-33693* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SIMULATOR EVALUATION OF A PERSPECTIVE CLIPPED-POLE DISPLAY AND A THRUST-VECTOR CONTROLLER FOR VTOL ZERO-ZERO LANDINGS
M. R. Murphy and R. K. Greif *In its* 11th Ann. Conf. on Manual Control May 1975 p 268-282 refs (For availability see N75-33675 24-54)
CSCL 05H

Five pilots participated in a simulator study to evaluate design features of a perspective clipped pole display and a side arm thrust vector controller for potential applications to VTOL zero visibility landings. Analyses of objective measures by a t test for related means showed significant learning effects, but did not show significant performance differences among display conditions. A mean longitudinal touchdown velocity of less than 4 knots, a mean vertical touchdown velocity of less than 1.22m/sec, and a mean longitudinal position error of approximately 15.24 m were attained during the final 10 trials of the experiment. The conclusion that adequate airspeed and altitude cues could be obtained from the glideslope and runway poles is supported by the absence of significant performance differences among display conditions. Author

N75-33694* Medical Research Council, Cambridge (England). Applied Psychology Unit.
LAGGED LOW ORDER CONTROL SYSTEMS WITH POWERED CONTROLS
E. C. Poulton *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 284-296 refs (For availability see N75-33675 24-54)
CSCL 05H

With powered controls, a high order control system can be changed to a lower order control system with a lag, which is better suited to our position control skills and strategies. Separate groups of untrained men were trained on an acceleration control system, or on a rate control system with an exponential lag of either .5, 2, or 4 sec. Acquisition time was reliably shorter with all the lagged rate control systems than with the unlagged acceleration control system. Author

N75-33695* Calspan Corp., Buffalo, N.Y.
RESULTS OF A FLIGHT INVESTIGATION OF CONTROL-DISPLAY INTERACTIONS FOR VTOL DECELERATING DESCENDING INSTRUMENT APPROACHES USING THE X-22A AIRCRAFT
J. V. Lebacqz and E. W. Aiken *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 297-324 refs Sponsored in part by NASA (For availability see N75-33675 24-54)
(Contract N00019-73-C-0504)
CSCL 05H

Control, display, and guidance requirements for VTOL instrument transitions were studied to provide meaningful data related to the interaction of aircraft control system and pilot display characteristics on pilot rating and performance during a steep decelerating descending transition from a representative forward velocity to the hover under simulated instrument conditions. Thirty seven evaluations were performed of combinations of five generic display presentations, ranging from position information only to four axis control directors, and five levels of control augmentation systems, ranging from rate augmentation only to decoupled velocity responses and automatic configuration changes. Primary results include the demonstration of an inverse relationship between control complexity and display sophistication and the definition of acceptable and satisfactory control display combinations. Author

N75-33696* Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
A SIMULATOR STUDY ON INFORMATION REQUIREMENTS FOR PRECISION HOVERING
James L. Lemons and Theodor A. Dukes (Princeton Univ.) *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 325-336 refs (For availability see N75-33675 24-54)
CSCL 01D

A fixed base simulator study of an advanced helicopter instrument display utilizing translational acceleration, velocity and position information is reported. The simulation involved piloting a heavy helicopter using the Integrated Trajectory Error Display (ITED) in a precision hover task. The test series explored two basic areas. The effect on hover accuracy of adding acceleration information was of primary concern. Also of interest was the operators' ability to use degraded information derived from less sophisticated sources. The addition of translational acceleration to a display containing velocity and position information did not appear to improve the hover performance significantly However, displayed acceleration information seemed to increase the damping of the man machine system. Finally, the pilots could use translational information synthesized from attitude and angular acceleration as effectively as perfect acceleration. Author

N75-33697* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A MODEL-BASED ANALYSIS OF A DISPLAY FOR HELICOPTER LANDING APPROACH
Ronald A. Hess and L. William Wheat *In its* 11th Ann. Conf. on Manual Control May 1975 p 338-355 refs (For availability see N75-33675 24-54)
CSCL 01D

A control theoretic model of the human pilot was used to

analyze a baseline electronic cockpit display in a helicopter landing approach task. The head down display was created on a stroke written cathode ray tube and the vehicle was a UH-1H helicopter. The landing approach task consisted of maintaining prescribed groundspeed and glideslope in the presence of random vertical and horizontal turbulence. The pilot model was also used to generate and evaluate display quickening laws designed to improve pilot vehicle performance. A simple fixed base simulation provided comparative tracking data. Author

N75-33698* Martin Marietta Corp., Denver, Colo.
SIMULATION OF MAN-MACHINE INTERACTION ON SHUTTLE PAYLOAD MANIPULATOR
R. O. Hookway and R. S. Jackson *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 356-376 refs (For availability see N75-33675 24-54)
CSCL 05H

The main objective of this simulation was to evaluate the feasibility of a simplified control system for a remote manipulator for space shuttle payloads. The motion commanded by the operator through the control system to the six degree of freedom manipulator approximates that of a backhoe. Compatibility of low arm damping, heavy payloads, small clearances in the shuttle cargo bay and stringent mission timelines were evaluated. The effects of various devices to enhance visual cues were evaluated. Phase I of the simulation was capture of a payload flying free in space relative to the shuttle. Phase II was simulation of cargo stowage into a mockup of the space shuttle cargo bay. A shuttle remote manipulator control station mockup including TV monitors and hand controllers is used in the simulation. Results evaluating various parameters of the control system and the task, including arm flexibility, are presented. Author

N75-33699* Army Avionics Lab., Ft. Monmouth, N.J.
UNIQUE WIDE FIELD OF VIEW VISUAL SIMULATION
John Niemela *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 377-382 (For availability see N75-33675 24-54)
CSCL 05E

Visual simulations are required to support investigations of the man-machine aspects of helicopter nap-of-the-earth flight. The visual simulation requirements are discussed vis-a-vis available technology. A wide field of view of the world outside the cockpit is necessary to provide adequate visual cues to the pilot. A unique design is described employing three TV monitors, collimating lenses, and electronics to selectively display a wide field of view without the use of a costly wide angle optical probe. Author

N75-33700* Systems Technology, Inc., Hawthorne, Calif.
TEST PROCEDURES AND PERFORMANCE MEASURES SENSITIVE TO AUTOMOBILE STEERING DYNAMICS
Richard H. Klein, Duane T. McRuer, and David Weir *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 383-395 refs (For availability see N75-33675 24-54)
(Contract DOT-HS-359-3-762)
CSCL 05H

A maneuver complex and related performance measures used to evaluate driver/vehicle system responses as effected by variations in the directional response characteristics of passenger cars are described. The complex consists of normal and emergency maneuvers (including random and discrete disturbances) which, taken as a whole, represent all classes of steering functions and all modes of driver response behavior. Measures of driver/vehicle system response and performance in regulation tasks included direct describing function measurements and rms yaw velocity. In transient maneuvers, measures such as steering activity and cone strikes were used. Author

N75-33701* Systems Technology, Inc., Hawthorne, Calif.
AN INTERACTIVE DRIVING SIMULATION FOR DRIVER CONTROL AND DECISION-MAKING RESEARCH
R. Wade Allen, Jeffrey R. Hogge, and Stephen H. Schwartz *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 396-407 refs (For availability see N75-33675 24-54)
CSCL 05H

Display techniques and equations of motion for a relatively simple fixed base car simulation are described. The vehicle dynamics include simplified lateral (steering) and longitudinal (speed) degrees of freedom. Several simulator tasks are described which require a combination of operator control and decision making, including response to wind gust inputs, curved roads, traffic signal lights, and obstacles. Logic circuits are used to detect speeding, running red lights, and crashes. A variety of visual and auditory cues are used to give the driver appropriate performance feedback. The simulated equations of motion are reviewed and the technique for generating the line drawing CRT roadway display is discussed. On-line measurement capabilities and experimenter control features are presented, along with previous and current research results demonstrating simulation capabilities and applications. Author

N75-33702* Systems Technology, Inc., Hawthorne, Calif.
EFFECTS OF AUTOMOBILE STEERING CHARACTERISTICS ON DRIVER VEHICLE SYSTEM DYNAMICS IN REGULATION TASKS
Duane T. McRuer and Richard Klein *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 408-439 refs (For availability see N75-33675 24-54)
CSCL 05E

A regulation task which subjected the automobile to a random gust disturbance which is countered by driver control action is used to study the effects of various automobile steering characteristics on the driver/vehicle system. The experiments used a variable stability automobile specially configured to permit insertion of the simulated gust disturbance and the measurement of the driver/vehicle system characteristics. Driver/vehicle system dynamics were measured and interpreted as an effective open loop system describing function. Objective measures of system bandwidth, stability, and time delays were deduced and compared. These objective measures were supplemented by driver ratings. A tentative optimum range of vehicle dynamics for the directional regulation task was established. Author

N75-33703* Ohio State Univ., Columbus.
A KINESTHETIC-TACTUAL DISPLAY FOR STALL DETERRENCE
Richard D. Gilson, Ronald W. Ventola, and Robert E. Fenton *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 440-451 refs (For availability see N75-33675 24-54)
(Contract DOT-FA74WA-3515)
CSCL 05E

A kinesthetic tactual display may be effectively used as a control aid per previous flight tests. Angle of attack information would be continuously presented to a pilot, via this display, during critical operational phases where stalls are probable. A two phase plan for evaluating this concept is presented. A first development phase would encompass: (1) display fabrication for a conventional control yoke; (2) its installation, together with other necessary instrumentation, in an experimental aircraft; and (3) preliminary flight testing by experienced pilots. Author

N75-33704* Tufts Univ., Medford, Mass.
VERBAL WORKLOAD IN DISTRIBUTED AIR TRAFFIC MANAGEMENT
J. G. Kreifeldt, B. Pardo (Calif. State Univ.), T. E. Wempe (NASA. Ames Res. Center), and E. Huff (NASA. Ames Res. Center) *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 455-471 refs (For availability see N75-33675 24-54)
(Grants NGR-05-046-002; NCAR-785-401)
CSCL 17B

The effects of alternative traffic management possibilities on task performance and pilot controller verbal workloads were studied. Two new rule structures - sequencing and advisory - in addition to vectoring were studied in conjunction with CRT pilot displays incorporating traffic situation displays with and without aircraft flight path predictors. The sequencing and advisory systems gave increasing control responsibility to the pilots. It was concluded that distributed management systems could in practice significantly reduce controller verbal workload without reducing system performance. Implications of this conclusion suggest that distributed management would allow controllers to handle a larger volume of traffic safely either as a normal operating procedure

or as a failure mode alternative in a highly automated ground centered system. Author

N75-33705* Systems Technology, Inc., Hawthorne, Calif.
EFFECTS OF AUTOMOBILE STEERING CHARACTERISTICS ON DRIVER/VEHICLE SYSTEM PERFORMANCE IN DISCRETE MANEUVERS
Richard H. Klein and Duane T. McRuer *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 472-485 refs (For availability see N75-33675 24-54)
(Contract DOT-HS-359-3-762)
CSCL 05H

A series of discrete maneuver tasks were used to evaluate the effects of steering gain and directional mode dynamic parameters on driver/vehicle responses. The importance and ranking of these parameters were evaluated through changes in subjective driver ratings and performance measures obtained from transient maneuvers such as a double lane change, an emergency lane change, and an unexpected obstacle. The unexpected obstacle maneuver proved more sensitive to individual driver differences than to vehicle differences. Results were based on full scale tests with an experienced test driver evaluating many different dynamic configurations plus seventeen ordinary drivers evaluating six key configurations. Author

N75-33706* Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
THE EFFECTS OF STABILITY AUGMENTATION ON THE GUST RESPONSE OF A STOL AIRCRAFT DURING A CURVED MANUAL APPROACH
Milton B. Porter, Jr. and Robert L. Swaim (Purdue Univ.) *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 486-503 refs (For availability see N75-33675 24-54)
CSCL 05H

The task of investigating the effect of SAS was formulated as two optimal control problems for stochastic systems: (1) to compute SAS gains with a rate model in the performance index algorithm; and (2) to calculate the pilot gains and system gust response using an optimal pilot model. Both problems were solved to yield reasonable low gains for the pilot and SAS, and the lateral directional mode poles and the longitudinal short period poles could be placed accurately by the model matching algorithm. Of the longitudinal (SAS) poles achieved, the vertical rms path error was least for the unaugmented poles. The lateral rms path error was an order of magnitude larger than the vertical error and showed a plus or minus 50 percent variation with SAS. It increased with dutch roll frequency and damping, and it decreased most significantly with increased roll stability. The variation in lateral error with bank angle for curved flight was also a significant function of the augmented poles. Author

N75-33707* Tufts Univ., Medford, Mass. Dept. of Engineering Design.
SUBJECTIVE EVALUATION WITH FAA CRITERIA: A MULTIDIMENSIONAL SCALING APPROACH
J. G. Kreifeldt, L. Parkin, T. E. Wempe (NASA. Ames Res. Center), and E. F. Huff (NASA. Ames Res. Center) *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 504-525 refs (For availability see N75-33675 24-54)
(Grant NCAR-785-401)
CSCL 05E

Perceived orderliness in the ground tracks of five A/C during their simulated flights was studied. Dynamically developing ground tracks for five A/C from 21 separate runs were reproduced from computer storage and displayed on CRTS to professional pilots and controllers for their evaluations and preferences under several criteria. The ground tracks were developed in 20 seconds as opposed to the 5 minutes of simulated flight using speedup techniques for display. Metric and nonmetric multidimensional scaling techniques are being used to analyze the subjective responses in an effort to: (1) determine the meaningfulness of basing decisions on such complex subjective criteria; (2) compare pilot/controller perceptual spaces; (3) determine the dimensionality of the subjects' perceptual spaces; and thereby (4) determine objective measures suitable for comparing alternative traffic management simulations. Author

N75-33708* Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
SLUSHY WEIGHTINGS FOR THE OPTIMAL PILOT MODEL
James D. Dillow, Douglas G. Picha, and Ronald O. Anderson *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 526-540 refs (For availability see N75-33675 24-54)
CSCL 05H

A pilot model is described which accounts for the effect of motion cues in a well defined visual tracking task. The effect of visual and motion cues are accounted for in the model in two ways. First, the observation matrix in the pilot model is structured to account for the visual and motion inputs presented to the pilot. Secondly, the weightings in the quadratic cost function associated with the pilot model are modified to account for the pilot's perception of the variables he considers important in the task. Analytic results obtained using the pilot model are compared to experimental results and in general good agreement is demonstrated. The analytic model yields small improvements in tracking performance with the addition of motion cues for easily controlled task dynamics and large improvements in tracking performance with the addition of motion cues for difficult task dynamics. Author

N75-33709* National Aerospace Lab., Amsterdam (Netherlands).
A THEORETICAL STUDY OF THE PILOT AS A SYSTEM MONITOR
P. H. Wewerinke *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 541-547 refs (For availability see N75-33675 24-54)
CSCL 05H

The ever increasing complexity of aerospace vehicles is associated with a greater emphasis on the monitor and decision making functions of the pilot. This paper deals with the perceptual load imposed on the pilot monitoring his system. A theoretical model of this load is tested against experimental data. This model is based on a system state estimation model to be associated with the internal representation of the task environment. Author

N75-33710* Wright State Univ., Dayton, Ohio.
HUMAN PERFORMANCE EVALUATION IN DUAL-AXIS CRITICAL TASK TRACKING
Malcolm L. Ritchie and N. S. Nataraj (Sinclair Community Coll.) *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 548-560 refs (For availability see N75-33675 24-54)
CSCL 05E

A dual axis tracking using a multiloop critical task was set up to evaluate human performance. The effects of control stick variation and display formats are evaluated. A secondary loading was used to measure the degradation in tracking performance. Author

N75-33711* Operating Systems, Inc., Tarzana, Calif.
CONTINUOUS PERFORMANCE MEASUREMENT IN FLIGHT SYSTEMS
Edward M. Connelly, Nicholas A. Sloan, and Robert M. Zeskind *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 561-573 (For availability see N75-33675 24-54)
CSCL 05H

The desired response of many man machine control systems can be formulated as a solution to an optimal control synthesis problem where the cost index is given and the resulting optimal trajectories correspond to the desired trajectories of the man machine system. Optimal control synthesis provides the reference criteria and the significance of error information required for performance measurement. The synthesis procedure described provides a continuous performance measure (CPM) which is independent of the mechanism generating the control action. Therefore, the technique provides a meaningful method for online evaluation of man's control capability in terms of total man machine performance. Author

N75-33712* Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
PROBLEMS, QUESTIONS AND RESULTS IN THE USE OF THE BBN-MODEL

Dieter Dey *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 577-598 refs (For availability see N75-33675 24-54)
CSCL 05E

A hierarchical structured control model was used to describe pilot performance in a multivariable control problem. The model is based on the assumption that a well trained operator optimized a quadratic optimization criterion. The model considers some special characteristics of the human operator as time delay, neuromuscular time lag, observation and motor noise and the ability to extract the first derivative of a displaced value. Numerical results of a simple human engineering example using the BBN model demonstrate the influence of the variation of different parameters on covariance matrices of the state and observation vectors. G.G.

N75-33713* Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
PERFORMANCE EVALUATION OF TRACKING BASED ON A LOW PASS FILTER MODEL
Daniel W. Repperger and Andrew M. Junker *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 599-624 refs (For availability see N75-33675 24-54)
CSCL 05E

The performance of a human in a closed loop tracking task can be determined by using a simple low pass filter model with a least squares identification algorithm. The crossover model and the extended crossover model can be shown to be special cases of the low pass filter model presented here. Performance in tracking can be easily determined by mean square tracking error which can be written in terms of the parameters of the low pass filter model. A closed form expression for the effective time delay is also obtained. Experimental data from a roll axis tracking simulation is presented and simple prediction rules are determined. A comparison is made between this model and the crossover model with respect to their differences and similarities. Author

N75-33714* National Aerospace Lab., Tokyo (Japan).
A STUDY OF PILOT BEHAVIOR DURING CONTROLLING THE LATERAL DIRECTIONAL MOTION OF AIRPLANES IN TURBULENT AIR
Goro Beppu *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 625-644 refs (For availability see N75-33675 24-54)
CSCL 05H

The pilot behaviors controlling the lateral directional motion of airplanes in turbulent air have been investigated by using the pilot transfer function which has been obtained by the analysis of flight test data. The pilot uses the gains for the aileron manipulation proportionally to bank angle so as to minimize r.m.s. of bank angle. The pilot rudder manipulations are done proportionally to rolling velocity, yawing velocity, and yaw angle. Namely, the pilot carries out the cross control for the rudder. Author

N75-33715* Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
A MULTILOOP APPROACH TO MODELING MOTION SENSOR RESPONSES
Andrew M. Junker, Daniel W. Repperger, and John A. Neff (AFOSR) *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 645-655 refs (For availability see N75-33675 24-54)
CSCL 05H

By using a least squares identification algorithm, a multiloop approach is taken to effectively model the response characteristics of the motion sensors. The inputs to the model include the possible sources of information provided to the human via his motion sensing system. One input models the response of the angular acceleration sensors (second derivative of position) and the second input models the response of the linear sensors (sine of position). The third input is the visual display error provided to the human in the closed loop tracking experiment. Data from a roll axis tracking simulation were analyzed. The major source of pilot lead under the motion mode of operation is discussed for control of plants in which motion information improved performance and in which there was no improvement in performance. Author

N75-33716* Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
EFFECTS OF CONTROL-STICK PARAMETERS ON TRACKING PERFORMANCE IN A VIBRATION ENVIRONMENT
William H. Levison *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 656-674 refs (For availability see N75-33675 24-54)
(Contract F33615-74-C-4041)
CSCL 05H

A set of manual control experiments was conducted to determine the effects of control stick parameters on tracking performance in a vibration environment. Primary experimental variables were stick design parameters, stick location, and presence or absence of vibration. Considerable effect on control activity suggests that stick design parameters will significantly influence overall performance in systems that respond at vibration frequencies. Stick location had no significant effect on either tracking or biodynamic performance measures. The vibration correlated component of tracking error was relatively small. A model based guide for the design of control sticks in a vibration environment is described. This model is based on the state variable model for pilot/vehicle systems. Effects of vibration are represented as additional model elements and by changes in pilot related parameters of the tracking model. Author

N75-33717* Systems Control, Inc., Palo Alto, Calif.
EVALUATION OF OPTIMAL CONTROL TYPE MODELS FOR THE HUMAN GUNNER IN AN ANTI-AIRCRAFT ARTILLERY (AAA) SYSTEM
Anil V. Phatak and Kenneth M. Kessler *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 675-683 refs (For availability see N75-33675 24-54)
(Contract F33615-75-C-0016)
CSCL 05H

The selection of the structure of optimal control type models for the human gunner in an anti aircraft artillery system is considered. Several structures within the LQG framework may be formulated. Two basic types are considered: (1) kth derivative controllers; and (2) proportional integral derivative (P-I-D) controllers. It is shown that a suitable criterion for model structure determination can be based on the ensemble statistics of the tracking error. In the case when the ensemble tracking steady state error is zero, it is suggested that a P-I-D controller formulation be used in preference to the kth derivative controller. Author

N75-33718* Systems Technology, Inc., Hawthorne, Calif.
COMPARISON OF HUMAN DRIVER DYNAMICS IN SIMULATORS WITH COMPLEX AND SIMPLE VISUAL DISPLAYS AND IN AN AUTOMOBILE ON THE ROAD
Duane T. McRuer and Richard H. Klein *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 684-692 refs (For availability see N75-33675 24-54)
(Contract DOT-HS-359-3-762)
CSCL 05H

As part of a comprehensive program exploring driver/vehicle system response in lateral steering tasks, driver/vehicle system describing functions and other dynamic data have been gathered in several milieu. These include a simple fixed base simulator with an elementary roadway delineation only display; a fixed base statically operating automobile with a terrain model based, wide angle projection system display; and a full scale moving base automobile operating on the road. Dynamic data with the two fixed base simulators compared favorably, implying that the impoverished visual scene, lack of engine noise, and simplified steering wheel feel characteristics in the simple simulator did not induce significant driver dynamic behavior variations. The fixed base vs. moving base comparisons showed substantially greater crossover frequencies and phase margins on the road course. Author

N75-33719* Systems Technology, Inc., Hawthorne, Calif.
MANUAL AND AUTOMATIC CONTROL OF SURFACE EFFECT SHIPS
Warren F. Clement, John J. Shanahan, and R. Wade Allen *In* NASA. Ames Res. Center 11th Ann. Conf. on Manual Control May 1975 p 693-710 (For availability see N75-33675 24-54)

(Contract N00024-73-C-0914)
CSCL 05H

A recent investigation of crew performance in the motion environment of a large generic high speed surface effect ship by means of a motion base simulation addressed some of the helmsman's control task with an external forward visual field of the seascape and navigation and steering displays in the pilot house. In addition to the primary steering control task, a subcritical speed tracking task provided a secondary surrogate for trimming the water speed of the craft. The results of helsmen's steering describing function measurements are presented, and some suggestions for their interpretation are offered. The likely steering loop closures comprise heading and lateral displacement for the course keeping task investigated. Also discussed is the manner in which these loop closures were implemented for automatic steering of the surface effect ship. Regardless of the influence of workload, steering technique, water speed and sea state, the helmsmen apparently adopted a disturbance regulation bandwidth of about 0.2 rad/sec for lateral displacement. Author

N75-33720*# Boeing Co., Houston, Tex.
CREW APPLIANCE CONCEPTS. VOLUME 1, APPENDIX A: BIBLIOGRAPHY
B. W. Proctor, R. P. Reysa, and D. J. Russell 25 Jul. 1975 479 p refs
(Contract NAS9-13965)
(NASA-CR-144452; D2-118561-1-Vol-1-App-A) Avail: NTIS HC $12.00 CSCL 05H

A review of crew appliance related literature was made to provide background engineering information for development of conceptual appliance systems for the shuttle orbiter and the modular space station. From this review, a file containing abstracts of 299 appliance-related documents coded according to subject was developed along with a computerized bibliography of 682 references. Trade studies were conducted using information from these references to determine the optimum concepts to satisfy the shuttle and space station mission requirements. An appliance system was devised for each vehicle which has minimum impact to the respective environmental control system with the smallest possible weight, volume, and electrical penalty. Engineering parameters for each appliance concept considered are presented along with the total thermal and electrical loads and weight and volume penalties for each of the optimized appliance systems. Author

N75-33721*# Boeing Co., Houston, Tex.
CREW APPLIANCE CONCEPTS. VOLUME 2, APPENDIX B: SHUTTLE ORBITER APPLIANCES SUPPORTING ENGINEERING DATA
B. W. Proctor, R. P. Reysa, and D. J. Russell 25 Jul. 1975 331 p
(Contract NAS9-13965)
(NASA-CR-144453; D2-118561-2-Vol-2-App-B) Avail: NTIS HC $9.50 CSCL 05H

Technical data collected for the food management and personal hygiene appliances considered for the shuttle orbiter are presented as well as plotted and tabulated trade study results for each appliance. Food storage, food operation, galley cleanup, waste collection/transfer, body cleansing, and personal grooming were analyzed. F.O.S.

N75-33722*# Boeing Co., Houston, Tex.
CREW APPLIANCE CONCEPTS. VOLUME 3, APPENDIX B: SHUTTLE ORBITER APPLIANCES SUPPORTING ENGINEERING DATA
B. W. Proctor, R. P. Reysa, and D. J. Russell 25 Jul. 1975 400 p
(Contract NAS9-13965)
(NASA-CR-144454; D2-118561-3-Vol-3-App-B) Avail: NTIS HC $10.25 CSCL 05H

Technical data collected for housekeeping, off-duty activities, and medical appliances considered for the shuttle orbiter are presented. Equipment cleaning, refuse management, garment/linen maintenance, entertainment, physical conditioning, sterilization, and physical monitoring were analyzed. F.O.S.

N75-33723*# Boeing Co., Houston, Tex.
CREW APPLIANCE CONCEPTS. VOLUME 4, APPENDIX C: MODULAR SPACE STATION APPLIANCES SUPPORTING ENGINEERING DATA
B. W. Proctor, R. P. Reysa, and D. J. Russell 25 Jul. 1975 371 p
(Contract NAS9-13965)
(NASA-CR-144455; D2-118561-4-Vol-4-App-C) Avail: NTIS HC $10.00 CSCL 05H

Data collected for the appliances considered for the space station are presented along with plotted and tabulated trade study results for each appliance. The food management, and personal hygiene data are applicable to a six-man mission of 180-days. F.O.S.

N75-33724*# Boeing Co., Houston, Tex.
CREW APPLIANCE CONCEPTS. VOLUME 5, APPENDIX C: MODULAR SPACE STATION APPLIANCES SUPPORTING ENGINEERING DATA
B. W. Proctor, R. P. Reysa, and D. J. Russell 25 Jul. 1975 331 p
(Contract NAS9-13965)
(NASA-CR-144456; D2-118561-5-Vol-5-App-C) Avail: NTIS HC $9.50 CSCL 05H

Housekeeping, off-duty, and medical data concerning the appliances considered for the space station are presented. Appliance functions analyzed include: cleanup, collection, processing and storage of refuse; crew entertainment and physical exercise, and the autoclaves and ergometers. F.O.S.

N75-33725*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN IMPROVED LOAD HANDLING DEVICE Patent Application
John L. Burch, Peter H. Broussard, Jr., and Calvin O. Mueller, inventors (to NASA) Filed 16 Sep. 1975 17 p
(NASA-Case-MFS-23233-1; US-Patent-Appl-SN-613845) Avail: NTIS HC $3.25 CSCL 06K

An improved load handling device particularly suited for use as an escape device for high altitude structures is reported. The device is characterized by a vertically oriented base, adapted to be mounted near a selected opening of a building or the like, having mounted thereon a capstan including a drum supported for rotation. A storage reel is mounted on the base in spaced relation with the drum. A flexible line is stored in a variable number of turns on the storage reel and wound about the drum in a fixed number of turns for suspending loads attached. A double acting dashpot restrains the drum against load induced rotation. NASA

N75-33726*# General Dynamics/Convair, San Diego, Calif.
BOSCH CO2 REDUCTION SYSTEM DEVELOPMENT Interim Report
R. F. Holmes, C. D. King, and E. E. Keller Jul. 1975 53 p refs
(Contract NAS8-27276)
(NASA-CR-143959; CASD-NAS-75-030; IR-3) Avail: NTIS HC $4.25 CSCL 06K

Refinements in the design of a Bosch CO2 reduction unit for spacecraft O2 production are described. Sealing of the vacuum insulation jacket was simplified so that high vacuum and high insulation performance are easily maintained. The device includes a relatively simple concentric shell recuperative heat exchanger which operates at approximately 95% temperature effectiveness and helps lower power consumption. The influence of reactor temperature, pressure, and recycle gas composition on power consumption was investigated. In general, precise control is not required since power consumption is not very sensitive to moderate variations of these parameters near their optimum values. There are two process rate control modes which match flow rate to process demand. Catalyst conditioning, support, and packing pattern developments assure consistent starts, reduced energy consumption, and extended cartridge life. Operation levels for four or five men were maintained with overall power input values of 50 to 60 watts per man. Author

N75-33727# Coast Guard, Washington, D.C. Pollution Prevention Projects Branch.
SURVEY OF PERSONNEL PROTECTIVE CLOTHING AND RESPIRATORY APPARATA FOR USE BY COAST GUARD

PERSONNEL IN RESPONSE TO DISCHARGES OF HAZARDOUS CHEMICALS Final Report
W. M. Hammer and K. R. Nicholson Sep. 1974 79 p refs (AD-A010110; USCG-D-89-75) Avail: NTIS CSCL 06/17

A survey was conducted to determine the availability of protective clothing and breathing apparata, and their capability for protecting man from dangerous environments caused by discharges of hazardous chemicals. The information was evaluated to determine the applicability of the equipment to Coast Guard discharge amelioration responsibilities. GRA

N75-33728# Operations Research, Inc., Silver Spring, Md.
DESIGN CRITERIA FOR ADVANCED PFD'S Final Report
Robert B. Dayton Aug. 1974 129 p
(Contract DOT-CG-31446)
(AD-A010404; ORI-TR-861; USCG-D-76-75) Avail: NTIS CSCL 06/7

The study is devoted to an analysis of Personal Flotation Devices (PFD). An analytical model is developed which allows the PFD designer to select desirable PFD characteristics based on a typical accident scenario. In addition PFD design criteria are established based on wearability, physical effectiveness, and reliability parameters. Each of these parameters is analyzed in detail and their affect on PFD design discussed. PFD components and materials are surveyed and space age developments are analyzed for potential PFD application. The survey includes: inflation techniques, fabric and plastic materials, valves, puncture proofing, detection and automatic actuators. The design of an advanced PFD is developed using the analytical techniques and materials and components study. A prototype PFD is constructed and tested to verify the analysis. GRA

N75-33729# Texas Instruments, Inc., Dallas. Equipment Group.
MINE AIR MONITOR Final Report, 19 Jun. 1972 - 17 Jun. 1974
David Collins and Arnold Stalder 17 Jun. 1974 53 p
(Contract DI-BM-HO-122044)
(PB-242488/5; BM-OFR-43-75) Avail: NTIS HC $4.25 CSCL 08I

Two portable, battery powered, breathing air monitors are reported for toxic gases CO and NO2 and for oxygen deficiency for use in underground mines including coal mines. The device used commercially available electrochemical transducers, features audible and visual alarms with adjustable threshold levels, selectable digital readout of gas concentrations, alarm level set points, and battery condition. It can run continuously for 30 hours from batteries before recharging is necessary. This report details the design effort including electrochemical cell characterization of response versus temperature, and contains portions of operation and instruction manual. GRA

N75-33088* Martin Marietta Corp., Denver, Colo.
A MANIPULATOR ARM FOR ZERO-g SIMULATIONS
Shepard B. Brodie, Christopher Grant, and Janos J. Lazar *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 12 p (For availability see N75-33086 24-12)
CSCL 05H

N75-33095* McDonnell-Douglas Astronautics Co., St. Louis, Mo.
THE PERFORMANCE OF COMPONENTS IN THE SKYLAB REFRIGERATION SYSTEM
Charles E. Daniher, Jr. *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 18 p refs (For availability see N75-33086 24-12)
(Contract NAS9-6555)
CSCL 06K

N75-33097* McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SKYLAB TRASH AIRLOCK
Larry R. Price *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 12 p (For availability see N75-33086 24-12)
(Contract NAS9-6555)
CSCL 06K

N75-33104* Rensselaer Polytechnic Inst., Troy, N.Y.
MODERN MECHANISMS MAKE MANLESS MARTIAN MISSION MOBILE: SPIN-OFF SPELLS STAIRCLIMBING SELF-SUFFICIENCY FOR EARTHBOUND HANDICAPPED
George N. Sandor, David R. Hassel, and Philip F. Marino *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 18 p refs (For availability see N75-33086 24-12)
(Grant NGL-33-018-091)
CSCL 05H

N75-33107* Rockwell International Corp., Downey, Calif.
A UNIQUE CHALLENGE: ENERGY EGRESS AND LIFE SUPPORT EQUIPMENT AT KSC
Henry M. Waddell, Jr. *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 19 p (For availability see N75-33086 24-12)
CSCL 06K

N75-33999 National Research Council of Canada, Ottawa (Ontario). Control Systems and Human Engineering Lab.
CIRCADIAN RHYTHM IN PERFORMANCE ON THE NRC STRESSALYSER
Leslie Buck and Ralph Leonardo *In its* Quart. Bull. of the Div of Mech. Eng. and the Natl. Aeron. Estab., 1 Apr. - 30 Jun. 1975 30 Jun. 1975 p 11-31 refs (For availability see N75-33997 24-99)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N75-33730# California Univ., Livermore. Lawrence Livermore Lab.
REDUCED, A DATA REDUCTION CODE
N. Maron 22 Jan. 1975 32 p
(Contract W-7405-eng-48)
(UCRL-51742) Avail: NTIS HC $4.00

REDUCED, a FORTRAN program currently running on a Lawrence Livermore Laboratory (LLL) CDC 6600, provides a simple means of accumulating a large base of experimental data (up to 21 parameters for up to 500 experiments) and interactively making two-dimensional plots of any pair of functions of the parameters. For each experiment, each pair of function values is displayed as a discrete point. Linear or quadratic least-squares fits to the array of these points can be drawn. Results can be displayed on a variety of output media including printer/plotters, COM and CRT devices. User inputs required include a data base of parameter values; specification of functions to be performed; specification of symbols to appear on the actual plots; and

necessary control cards. This report includes a description of REDUCED, instructions on how to use it, and a source listing of the complete code. Author (NSA)

N75-33731# Centre National d'Etudes Spatiales, Toulouse (France).
THEORETICAL SYNTHESIS OF THE INFORMATION COMPRESSION METHODS [SYNTHESE THEORIQUE DES PROCEDES DE COMPRESSION DE L'INFORMATION]
Jean Bernard Deloly Apr. 1975 67 p refs In FRENCH; ENGLISH summary
(CNES-NT-13) Avail: NTIS HC $4.25

A survey of data compression methods for information contained in images indicates that it is useful for research efficiency to establish a theoretical synthesis of the information coding techniques known to date this was done with the following objectives: to establish the fundamental criteria concerning advantages of various coding methods; to simplify quantitative evaluations for a given problem; and to determine which research orientations would be most useful. Author (ESA)

N75-33732# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.
T-6 DIGITAL AUTOPILOT DATA PROCESSING ANALYSIS AND SPECIFICATION
C. Frank Asquity 5 Mar. 1975 65 p refs
(DA Proj. 1M3-62303-A-214)
(AD-A010353; RG-75-36) Avail: NTIS CSCL 16/4

This report describes the analysis required to specify the computer data processing for a digital autopilot for a small homing missile. The problem of conversion of an analog system to a digital system by state variable methods is examined. Modification of the resulting digital system to maintain system gain and phase margins is accomplished. Data rate and word length effects are studied and the decomposed state variable type formulation is found to be superior to the z-transform based recursive feedback form. GRA

N75-33733# Federal Cobol Compiler Testing Service, Washington, D.C.
UNIVAC 1108, ANSI/ASCII UN12.2H EXEC 8 Final Validation Summary Report
6 Dec. 1974 57 p
(AD-A002115; VSR-74.C003) Avail: NTIS CSCL 09/2

Results obtained from the validation of the compiler are presented. An overview of the validation which lists all categories of discrepancies by Federal level module, a section relating the categories of discrepancies to each of the Federal levels of the language, and a detailed listing of discrepancies together with the tests which were failed are included. GRA

N75-33734# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
REAL-TIME ACQUISITION AND PROCESSING OF FLUORIMETRY DATA
Peter S. Shoenfeld Jun. 1975 50 p refs
(COM-75-10739/1; NBS-TN-857) Avail: NTIS HC $3.75; HC also available from SOD as C13.46:857 CSCL 07D

The National Bureau of Standards Analytical Chemistry Division uses a centralized computer system to automate a number of experiments. Computer software for a fluorimetry application is described in this report. The file and program structure used is quite general and can be applied to other experiments as well. GRA

N75-33735# Massachusetts Inst. of Tech., Cambridge.
A PARALLEL ASYNCHRONOUS COMPUTER ARCHITECTURE FOR DATA FLOW PROGRAMS
James E. Rumbaugh May 1975 317 p refs Sponsored in part by ARPA
(Contract N00014-70-A-0362-0006; Proj. MAC)
(AD-A010918; MAC-TR-150) Avail: NTIS CSCL 09/2

This thesis involves the design of a parallel programming language and a parallel processor computer that runs programs expressed in that language. Data flow instructions have no side-effects; therefore unrelated instructions can be executed concurrently without interference if each has its required operands. Data flow procedures define functions from argument values to result values. The Data Flow Machine is hierarchically constructed as a network of simple modules. The behavior of the machine is specified by a formal description language. GRA

N75-33736# RAND Corp., Santa Monica, Calif.
SECURITY TEST AND EVALUATION TOOLS: AN APPROACH TO OPERATING SYSTEM SECURITY ANALYSIS
Dennis Hollingworth, Steve Glaseman, and Marsha Hopwood Sep. 1974 29 p refs
(AD-A010969; P-5298) Avail: NTIS CSCL 09/2

As a result of studies of the security characteristics of selected large operating systems, it has become increasingly evident that any complex operating system requires testing and evaluation in order to validate the functional characteristics of the system and verify claims of improved security safeguards. Furthermore, over the next decade, it is likely that new systems will be subject to continuous testing and evaluation in much the same fashion, and for the same purposes, as are existing systems. As yet, the techniques employed in determining the security characteristics of system software are presently quite primitive, based primarily upon the notion of penetration testing - manually examining system source materials for security vulnerabilities. This suggests the development and refinement of tools and techniques of operating system security analysis. Some of the more desirable characteristics of such tools are explored in this document, and several example tools are described. GRA

N75-33737# Harvard Univ., Cambridge, Mass. Aiken Computation Lab.
FORTRAN IMPLEMENTATIONS OF MARCHING ALGORITHMS Technical Report, Sep. 1974 - May 1975
Randolph E. Bank 27 May 1975 72 p refs
(Contract N00014-75-C-0243; NR Proj. 044-454)
(AD-A011107; TR-17-75) Avail: NTIS CSCL 09/2

FORTRAN implementations are given for several marching algorithms for solving the block tridiagonal linear systems which arise from standard 5-point difference approximations to elliptic boundary value problems in two dimensions. GRA

N75-33738# RAND Corp., Santa Monica, Calif.
COMPUTER SYSTEMS TECHNOLOGY FORECAST
Rein Turn Jan. 1975 33 p refs
(AD-A010944; P-5344) Avail: NTIS CSCL 09/2

A forecast of hardware characteristics of ground based and, in particular, aerospace computer systems for the 1980s is presented. It is expected that steady advances in the manufacture of large-scale integrated (LSI) logic circuit and memory arrays will lead to at least one order of magnitude improvement in performance characteristics of processors and memories, and will permit similar improvements in size, weight, reliability, and cost. The present advances in the LSI technology are driven largely by the competitive commercial markets. The market for extremely reliable, ruggedized LSI devices for aerospace and other military applications is much smaller and, correspondingly, their development must be supported by the user agencies. GRA

N75-33739# Syracuse Univ., N.Y.
DESIGN AND EVALUATION OF AN ARITHMETIC UNIT Interim Report, Jan. 1972 - Dec. 1973
Tse-Yun Feng and Chung-Ping Hsu Mar. 1975 134 p refs
(Contract F30602-72-C-0281)
(AD-A010625; RADC-TR-75-86) Avail: NTIS CSCL 09/2

Iterative array logic and several existing arrays for arithmetic operations are first reviewed. Then, for a large scale general purpose associative processor a modularized arithmetic unit is proposed and studied. The proposed arithmetic unit has the flexibility to perform arithmetic operations with any multiple of four bits being processed in parallel. While reducing the total number of words that can be processed simultaneously by a corresponding factor, the per-word execution time is decreased proportionally. This design will partially solve the problem of inefficient utilization of hardware facilities, especially arithmetic unit, for smaller applications. Algorithms are flow-charted and illustrated for full-length parallel and four-bit parallel arithmetic operations, which exemplify various parallel arithmetic operations. Finally, a comparison study is provided concerning full-length

parallel and m-bit parallel operations for various m, which is a multiple of 4 and less than the operand length. GRA

N75-33740# New Mexico Univ., Albuquerque. Eric H. Wang Civil Engineering Research Facility.
METHOD OF TRANSFER FUNCTION CALCULATION AND DISTORTED DATA CORRECTION Final Report, Nov. 1971 - Apr. 1973
George L. Schulz Mar. 1975 54 p refs Sponsored in part by DNA
(Contract F29601-72-C-0024)
(AD-A010637; AFWL-TR-73-300) Avail: NTIS

An effort was made to improve data records by compensating for the dynamic behavior of the data measuring and recording component or system. In the method developed, the fast Fourier transform algorithm is used to calculate the transfer function of the measuring component or system and then the transfer function is used to reconstruct the input data from the output of that component or system. Four sample problems were processed using this approach. In each case, this reconstruction process produced a record which was a much more accurate representation of the input than was the original output of the component. GRA

N75-33741# Mitre Corp., McLean, Va.
PARALLEL DERIVATIVES FOR MULTIPROCESSOR TASK SCHEDULING
J. K. Millen May 1975 94 p refs
(Contract F19628-75-C-0001; AF Proj. 7090)
(AD-A010591; MTR-2922; ESD-TR-75-61) Avail: NTIS CSCL 09/2

Three alternatives are presented for the design of a scheduler for a multi-miniprocessor system. The alternatives are based in general on the theory of parallel program schemata and in particular on a new parallel derivative technique for constructing the maximally parallel flowchart equivalent to a given one. GRA

N75-33742# Mitre Corp., McLean, Va.
DESIGN OF A SECURE FILE MANAGEMENT SYSTEM
J. C. C. White Apr. 1975 32 p refs
(Contract F19628-73-C-0001; AF Proj. 7070)
(AD-A010590; MTR-2931; ESD-TR-75-57) Avail: NTIS CSCL 09/2

A file management/operating system based on the PDP-11/45 Security Kernel is described. The system will allow complete sharing of files, subject to the control of the Security Kernel, so that problems brought about by the conflicting requirements for security and sharing can be identified and explored. It will provide a vehicle for experimentation with the extensions of the kernel required for multisource information correlation. GRA

N75-33743# Federal Cobol Compiler Testing Service, Washington, D.C.
HIS 6000 COBOL 2.0/H-EIS(ASTERISK)23 Final Validation Summary Report
12 Jun. 1975 47 p
(AD-A010928; VSR-75.C001) Avail: NTIS CSCL 09/2

This Validation Summary Report (VSR) provides a consolidated summary of the results obtained from the validation of the subject compiler. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by Federal level module; a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N75-33744# RAND Corp., Santa Monica, Calif.
COMPUTER PRIVACY AND COMPUTER SECURITY
Willis H. Ware Oct. 1974 8 p Repr. from Bull. of the Am. Soc. for Inform. Sci., v. 1, no. 3, Oct. 1974
(AD-A010965; P-5354) Avail: NTIS CSCL 09/2

The following topics are discussed: The privacy trade-off; Technical vs. legal problems; Legislating the issue; A limit to laws. GRA

N75-33125* IBM Federal Systems Div., Huntsville, Ala.
ALGORITHMS
In its Program Verification Doc. for the ASTP Flight Program 15 Apr. 1975 15 p refs (For availability see N75-33114 24-12)
CSCL 09B

N75-34000 National Research Council of Canada, Ottawa (Ontario). Analysis Lab.
INTERACTIVE COMPUTER MODELS OF INDUSTRIAL OPERATIONS
U. Graefe, L. K. Nenonen, and K. Strobele (Hatch, Associates, Toronto, Ontario) *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab., 1 Apr. - 30 Jun. 1975 30 Jun. 1975 p 33-43 refs (For availability see N75-33997 24-99)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N75-33745 Rice Univ., Houston, Tex.
LANGUAGE DIRECTED COMPUTER ARCHITECTURE Ph.D. Thesis
Larry Neil McMahan 1975 138 p
Avail: Univ. Microfilms Order No. 75-22041

A language directed computer architecture was designed by a method analogous to the process of stepwise program refinement. First, the area of programming linguistics is considered and a set of high level language primitives is developed, including such topics as statement structure, variable binding, environment access, expression evaluation, and transformation of values. Second, a dynamic process model is developed from the language primitives. The model consists of an algorithm representing the static program structure and an execution record composed of a control locus denoting the current point of evaluation and a universe of discourse containing the set of values known to the process. Third, the model is used as an architectural blueprint for a machine designed at a register transfer level. It is found that the language directed architecture has memory requirements and performs in a time frame equivalent to conventional machines while maintaining a far superior semantic capability. Dissert. Abstr.

N75-33746*# Brown and Ramamoorthy, Inc., Berkeley, Calif.
FORTRAN AUTOMATED CODE EVALUATION SYSTEM (FACES) SYSTEM DOCUMENTATION, VERSION 2, MOD 0
Sep. 1975 594 p
(Contract NAS8-30928)
(NASA-CR-143992) Avail: NTIS HC $13.25 CSCL 09B

A system is presented which processes FORTRAN based software systems to surface potential problems before they become execution malfunctions. The system complements the diagnostic capabilities of compilers, loaders, and execution monitors rather than duplicating these functions. Also, it emphasizes frequent sources of FORTRAN problems which require inordinate manual effort to identify. The principle value of the system is extracting small sections of unusual code from the bulk of normal sequences. Code structures likely to cause immediate or future problems are brought to the user's attention. These messages stimulate timely corrective action of solid errors and promote identification of 'tricky' code. Corrective action may require recoding or simply extending software documentation to explain the unusual technique. Author

N75-33747# Royal Aircraft Establishment, Farnborough (England).
A GENERAL PURPOSE PLOTTING LANGUAGE AND INTERPRETER PROGRAM FOR REMOTE PLOTTING ONLINE TO GEORGE 3
M. J. Martin Nov. 1974 28 p refs
(RAE-TR-74109; BR44393) Avail: NTIS HC $3.75

The generation of pictures using a simple command language is discussed. The use of this language allows different types of graphical output device to be used and can also be used to communicate graphical information between programs. A program PLOTCI and macro RUNPLOTCI have been written to interpret this command language and to allow remote online interactive

plotting using a graph plotter and teletype linked to an ICL 1904A computer. Author (ESA)

N75-33748# Stanford Univ., Calif. Systems Optimization Lab.
SOME COMPUTATIONAL EXPERIMENTS WITH SCOLNIK'S LINEAR PROGRAMMING APPROACH
Mohammad Saiidi and J. A. Tomlin Dec. 1974 11 p refs
(Contracts N00014-67-A-0112-0011; DAHC04-74-C-0034; NR Proj. 047-064)
(AD-A007149; SU-SOL-74-22; ARO-12215.4-M) Avail: NTIS CSCL 12/2

In this note the authors describe a reasonably efficient implementation of Scolnik's linear programming approach. The authors became interested in using the code to test the usefulness of this approach as a starting heuristic or crashing technique, as the method is known to fail in general. The computational experience, however, leads the authors to believe that the method is too costly even for this modest objective. GRA

N75-33749# National Bureau of Standards, Washington, D.C. Applied Mathematics Div.
THE NBS COMPUTERIZED CARPOOL MATCHING SYSTEM: USER'S GUIDE Final Technical Report
Judith F. Gilsinn and Susan Landau Dec. 1974 65 p
(COM-75-10691/4; NBSIR-74-633) Avail: NTIS HC $4.25 CSCL 13B

The report includes flowcharts, input/output formats, and program listings for the programs, plus details of the manual process for coordinate coding. The matching program produces, for each person desiring it, a list of others residing within a pre-specified distance of him, and is thus applicable to a single work destination having primarily one work schedule. The system is currently operational on the UNIVAC 1108 computer and was run in March of 1974, producing lists for about 950 employees in less than four minutes computer time. Subsequent maintenance of the system will be carried out by the NBS Management and Organization Division. GRA

N75-33750# University of Southern Calif., Marina del Rey. Information Sciences Inst.
AN INTELLIGENT TUTOR ON-LINE DOCUMENTATION AND HELP FOR MILITARY MESSAGE SERVICE
Jeff Rothenberg May 1975 39 p refs
(Contract DAHC15-72-C-0308; ARPA Order 2223)
(AD-A010186; ISI/RR-74-26) Avail: NTIS CSCL 05/9

The military message service proposed by ISI's Information Automation project is designed to provide full documentation, help, and error-reporting facilities on-line. The Tutor serves these functions by accessing a documentation (or Help) data base which contains multilevel descriptions for every semantic entity used in the interface between the service and the user. These descriptions are expandable with respect to the amount and type of information presented, as well as with respect to the user's level of proficiency and experience, as indicated by a User Profile. The Tutor also provides a facility for on-line computer-aided instruction. It can be invoked explicitly by the user's request for help, or by the Command Language Processor and User Monitor in response to unrecognized commands, inefficient operation, or error conditions. GRA

N75-33751# Computer Corp. of America, Cambridge, Mass.
DATACOMPUTER SUPPORT OF SEISMIC DATA ACTIVITY Quarterly Technical Report, 1 Nov. 1974 - 31 Jan. 1975
21 Mar. 1975 41 p
(Contract MDA903-74-C-0227; DARPA Order 2613)
(AD-A006932) Avail: NTIS CSCL 08/11

The purpose of the project is to support the ARPA-NMRO Seismic Data Activity by providing data storage and retrieval services. The Arpanet will be used as the communication channel. As part of the service, seismic data will be (a) collected from the Arpanet; (b) stored; and (c) made available to computers on the Arpanet in a convenient and timely manner. These services represent a special application of the Arpanet Datacomputer. The activity on the project to date has been primarily in two areas: hardware acquisition and coordination with the seismic community. GRA

N75-33752# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
THE COMPLEXITY OF PARALLEL EVALUATION OF LINEAR RECURRENCES Interim Report
L. Hyafil (Inst. de Recherche d'Informatique et d'Automatique, Le Chesnay, France) Nov. 1974 14 p refs
(Contract N00014-67-A-0314-0010; Grant NSF GJ-32111; NR Proj. 044-422)
(AD-A001376) Avail: NTIS CSCL 09/2

The concept of computers such as C.mmp and ILLIAC 4 is to achieve computational speed-up by performing several operations simultaneously with parallel processors. This type of computer organization is referred to as a parallel computer. In this paper, the authors prove upper bounds on speed-ups achievable by parallel computers for a particular problem, the solution of first order linear recurrences. The authors consider this problem because it is important in practice and also because it is simply stated so that one might obtain some insight into the nature of parallel computation by studying it. GRA

N75-33753# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
OPTIMIZATION OF MICROCODE FOR HORIZONTALLY ENCODED MICROPROGRAMMABLE COMPUTERS
Andries VanDam and Gregory R. Lloyd 31 Oct. 1974 62 p refs
(Contract N00014-67-A-0191-0027)
(AD-A006937) Avail: NTIS CSCL 09/2

The various levels of microprogramming languages are categorized, and the problems specific to the efficient compilation of microcode for horizontal architectures are considered. A general model of the compilation and optimization processes is developed, and techniques are suggested for treating the optimization process as a number of distinct phases. Where analytic solutions are not feasible, heuristic techniques are suggested. GRA

N75-33754# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
EXTENSIONS OF SUBADDITIVE FUNCTIONS USED IN CUTTING-PLANE THEORY
Charles E. Blair Dec. 1974 16 p refs Sponsored in part by Office of Naval Res.
(AD-A009268; RR-360) Avail: NTIS CSCL 12/2

It is shown that the subadditive functions necessary for cutting-planes for mixed integer problems may be defined on all of (R sup n), rather than a submonoid. GRA

N75-33755# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
SOME ISSUES IN PROGRAMMING MULTI-MINI-PROCESSES Interim Report
A. Newell and G. Robertson Jan. 1975 35 p refs
(Contract F44620-73-C-0074; DARPA Order 2466)
(AD-A008858; AFOSR-75-0544TR) Avail: NTIS CSCL 09/2

Large computer systems can be constructed by joining together many minicomputers creating what can be called multi-mini-processors. The first such systems are just reaching the point where problems of programming and use dominate problems of design and construction. This paper attempts to share some of the early perceptions about what these problems of programming and use are. GRA

N75-33756# Army Materiel Command, Texarkana, Tex. Intern Training Center.
A MACRO PROGRAMMING LANGUAGE Final Report
Fred Charles Wilson Apr. 1975 57 p refs
(AD-A009294; USAMC-ITC-02-08-75-106) Avail: NTIS CSCL 09/2

This report is a basic introduction to macro processors and defines A Macro Programming Language (AMPL). AMPL is a PL/1 based macro definition language with certain SNOBOL4 features imbedded which was developed by the author. The language and this report are directed at users of high level languages and assumes no familiarity with macro facilities but does assume a broad knowledge of high level languages. GRA

N75-33757# National Institutes of Health, Bethesda, Md. Div. of Computer Research and Technology.

RMAGASM COMPILER: A BLOCK STRUCTURED 360/370 ASSEMBLY-LANGUAGE SOURCE-PROGRAM GENERATOR. USER'S GUIDE
Robert A. Magnuson 1 Apr. 1975 81 p refs
(PB-242172/5; NIH-DCRT-DMB-SSS-UG102B) Avail: NTIS HC $4.75 CSCL 09B

RMAGASM is a powerful compiler used to generate block-structured 360/370 assembly-language source code. It is used by adherents of structured programming as well as by those who want to understand all parts (ie., instructions, data, tables, etc.) of the programs they write. RMAGASM is itself a macro program implemented in the RMAG21 language. In addition to the usual structured programming features, it contains (a) the ability to handle sentential calculus schemata, (b) the power to generate translate tables, (c) a powerful macro facility, and, (d) the capacity to automatically indent generated code.
GRA

N75-33758# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
SOFTWARE TESTING FOR NETWORK SERVICES Final Report
Rona B. Stillman and Belkis Leong-Hong Jul. 1975 44 p refs
(Grant NSF AG-350)
(COM-75-10774/8; NBS-TN-874; LC-75-600046) Avail: NTIS HC $3.75; HC available from SOD as C13.46:874 CSCL 09B

The utility of two tools, the NBS FORTRAN Test Routines and the NBS Analyzer, is studied experimentally, and indications of their role in systematic testing in a networking environment are given.
GRA

N75-33759# Carnegie-Mellon Univ., Pittsburgh, Pa.
A USER MANUAL FOR GEOMETRIC PROGRAMMING
Abraham Lavi 15 Dec. 1974 69 p
(Grant NSF GI-39114)
(PB-242157/6; NSF/RANN/SE/GI-39114/TR/74/5; NSF/RA/N-74-199) Avail: NTIS HC $4.25 CSCL 12B

Geometric programming as an optimization tool is explained in simple language with as few mathematical concepts as possible. A computer code for solving geometric programming problems is provided. This code was developed by Westinghouse Research and Development Center and was made available to CMU gratis. The steps to be followed in using the program are given in detail; sample problems are solved, and the computer output is displayed and explained.
GRA

N75-33760# Wisconsin Univ., Madison. Mathematics Research Center.
A CONVERGENCE THEORY FOR A CLASS OF ANTI-JAMMING STRATEGIES Summary Report
R. R. Meyer Apr. 1975 33 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A011011; MRC-TSR-1481) Avail: NTIS CSCL 12/2

A convergence theory for a class of anti-jamming strategies for nonlinear programming algorithms is presented. This theory generalizes previous results in this area by Zoutendijk, Topkis and Veinott, Mangasarian, and others, and is applicable to algorithms in which the anti-jamming parameter is fixed at some positive value, as well as to those in which it tends to zero. In addition, under relatively weak hypotheses, convergence of the entire sequence of iterates is proved.
GRA

N75-33761# Naval Ship Research and Development Center, Bethesda, Md. Computation and Mathematics Dept.
CSKYDG2: AN OUT-OF-CORE CHOLESKY ALGORITHM FOR LARGE POSITIVE DEFINITE SYSTEMS OF LINEAR EQUATIONS
Donald A. Gignac Mar. 1975 38 p refs
(SR0140301)
(AD-A011039; NSRDC-4655) Avail: NTIS CSCL 09/2

In the finite element approach to static structural analysis the solution of the equation KU = P has been developed. However, the order of K is often so large that, even when the symmetry and banded structure of K are taken into account the storage of K in the core memory of a computer may not be feasible or even possible. To handle such a case, the computer program CSKYDG2 has been developed. CSKYDG2 is an out-of-core Cholesky algorithm solver for positive definite systems of simultaneous linear equations. CSKYDG2, which takes the profile approach, uses SETUP, a preprocessor program which stores the profile of the upper triangular half of the matrix K in random access files. CSKYDG2 and SETUP are written in FORTRAN Extended for the CDC 6000 series of computers.
GRA

N75-33762# Naval Research Lab., Washington, D.C. Acoustics Div.
A FORTRAN COMPUTER PROGRAM FOR COMPUTING THE GREAT CIRCLE ACOUSTIC PATH IN THE OCEAN FROM A SIGNAL SOURCE TO A HYDROPHONE SITE AND PLOTTING IT ON A MERCATOR CHART, PHASE 1 Final Report, Apr. 1972 - Nov. 1974
Leon P. LaLumiere, Jr. 23 May 1975 58 p
(NRL Proj. S01-37; XF52522700)
(AD-A011036; NRL-7881) Avail: NTIS CSCL 17/7

FRACZONE is a FORTRAN program designed to compute the spherical triangular acoustic reception zones based on empirical data and plot these zones on one or more Mercator charts.
GRA

N75-33763# Fleet Operations Control Center, Pacific Fleet, San Francisco, Calif.
USER'S GUIDE TO THE 160A AND 1604A UTILITY PROGRAMS, CHANGE 2
23 May 1975 13 p refs Revised
(AD-A010671; FOCCPAC-TN-12-Change-2) Avail: NTIS CSCL 09/2

Corrections to a previous document prepared for users of the 160A and 1604A utility programs were presented. The corrections either take the form of new pages replacing old pages, or pen and ink corrections to old pages.
Y.J.A.

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N75-33764*# Tennessee Univ., Knoxville. Electrical Engineering Dept.
GRAY-LEVEL TRANSFORMATIONS FOR INTERACTIVE IMAGE ENHANCEMENT M.S. Thesis. Final Technical Report
Barry Alan Fittes Sep. 1975 133 p refs
(Contract NAS8-29271)
(NASA-CR-143957; TR-EE/CS-75-20) Avail: NTIS HC $5.75 CSCL 09B

A gray-level transformation method suitable for interactive image enhancement was presented. It is shown that the well-known histogram equalization approach is a special case of this method. A technique for improving the uniformity of a histogram is also developed. Experimental results which illustrate the capabilities of both algorithms are described. Two proposals for implementing gray-level transformations in a real-time interactive image enhancement system are also presented.
Author

N75-33765# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany).
LOOP-FREE SWITCHING OF MEALY-AUTOMATA [ZUR SCHLEIFENFREIEN SCHALTUNG VON MEALY-AUTOMATEN]
Eckehart Hotzel 1974 109 p refs In GERMAN; ENGLISH summary

(GMD-Mitt-29) Avail: NTIS HC $5.25

A series of definitions and facts that are necessary or useful for an understanding of the Krohn-Rhodes theorem on loop-free decomposition of finite automata are given. A proof of this theorem along the line of Arbib and alternatives to this proof are indicated. Innovations include: a sharpened version of the decomposition theorem, a description of all finite cascade-irreducible and certain parallel-irreducible automata, and an answer to a question of Arbib on the possibility to split reset elements from an arbitrary semigroup. The algebraic character of the theory is emphasized. Author (ESA)

N75-33766# System Development Corp., Santa Monica, Calif.
USER'S GUIDE TO THE SOLAR SEMANTIC ANALYSIS FILE
Tom Bye, Timothy Diller, and John Olney 31 Apr. 1975 39 p refs
(Contract DAHC15-73-C-0080; ARPA Order 2254)
(AD-A009328; SDC-TM-5292/001/00) Avail: NTIS CSCL 05/7

The document contains a general explanation of the semantic analysis file of SOLAR (a Semantically-Oriented Lexical Archive). It is intended as an introduction and reference manual for the on-line user, the casual reader, or the data collector. The document indicates the design concepts, the resulting file structure, the intended file content, retrieval procedures, and data collection procedures. GRA

N75-33767# Illinois Univ., Urbana. Coordinated Science Lab.
A SYSTEMATIC NONLINEAR STATE FEEDBACK SUB-OPTIMAL CONTROL DESIGN FOR A CLASS OF NONLINEAR SYSTEMS
Angelo Augusto Yowg Apr. 1975 63 p refs
(Contract DAAB07-72-C-0259; Grant AF-AFOSR-3570-73)
(AD-A010730; R-675; UILU-ENG-75-2210) Avail: NTIS CSCL 12/1

The design of a nonlinear state feedback suboptimal control using parameter expansion techniques and the minimum principle is developed with a quadratic performance index to be minimized. The design is systematic when the nonlinearities of the system can be written as polynomial functions of the state variables. Then, the linear portion of the control is designed using the Riccati equation in the same way as in linear systems, and the nonlinear part is assumed to be homogeneous polynomials of the state variables with unknown coefficients that are in general function of t. A computer routine is developed to aid the determination of these coefficients. The method is applied to two examples. The first illustrates the design procedure and some features of the control, and the second is a study of a physical system. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N75-33768# Waterloo Univ. (Ontario). Dept. of Electrical Engineering.
A UNIFYING APPROACH TO THE CLASSICAL METHODS OF FORMULATING NETWORK EQUATIONS
Ranklin H. Branin, Jr. Dec. 1973 34 p refs
(UWEE/73.9) Avail: NTIS HC $3.75

The classical mesh, node, loop, cutset, hybrid, and state-variable methods of formulating network equations are all shown to be based on the same general process: block triangularization of an appropriate set of tableau equations, using symbolic Gaussian elimination. The triangularization is then completed by numerical Gaussian elimination. Thus, the classical methods subsume in their formulations a substantial portion of the solution process. Although this feature is desirable for handling small problems, it is detrimental to the efficient use of sparse matrix techniques for solving large problems on a computer. For completeness, both the composite branch and simple branch conventions are considered in discussing each method. Using the tableau approach throughout gives coherence to the formulation aspect of network analysis and puts the various methods into better perspective. Author

N75-33769*# Texas A&M Univ., College Station. Dept. of Mathematics.
A METHOD FOR ESTIMATING PROPORTIONS
L. F. Guseman, Jr. and Bruce P. Marion Apr. 1975 17 p refs
(Contract NAS9-13894)
(NASA-CR-144510; Rept-4) Avail: NTIS HC $3.25 CSCL 12A

A proportion estimation procedure is presented which requires only on set of ground truth data for determining the error matrix. The error matrix is then used to determine an unbiased estimate. The error matrix is shown to be directly related to the probability of misclassifications, and is more diagonally dominant with the increase in the number of passes used. Author

N75-33770*# National Aeronautics and Space Administration, Washington, D.C.
MATHEMATICAL TECHNIQUES: A COMPILATION Technology Utilization
Jul. 1975 25 p
(NASA-SP-5979(01)) Avail: NTIS HC $1.00 CSCL 12A

Articles on theoretical and applied mathematics are introduced. The articles cover information that might be of interest to workers in statistics and information theory, computational aids that could be used by scientists and engineers, and mathematical techniques for design and control. Author

N75-33771# North Carolina Univ., Chapel Hill. Dept. of Statistics.
ZERO-ONE LAWS FOR PATH DISCONTINUITIES OF OF GAUSSIAN PROCESSES Interim Report
Charles R. Baker and Stamatis Cambanis 8 May 1974 8 p refs
(Contract N00014-67-A-0321-0006; Grant AF-AFOSR-2386-72; AF Proj. 9769)
(AD-A010275; AFOSR-75-0646TR) Avail: NTIS CSCL 12/1

It is shown that with probability zero or one the paths of a separable Gaussian process with index set an interval have (1) a removable discontinuity, (2) only removable discontinuities, (3) only jumps, and (4) both jumps and removable discontinuities and no oscillatory discontinuities. GRA

N75-33772# Wisconsin Univ., Madison. Mathematics Research Center.
THE OPERATOR THEORY OF GENERALIZED BOUNDARY VALUE PROBLEMS
R. C. Brown Feb. 1975 53 p refs
(Contract DA-31-124-ARO(D)-462; Grant NSF GP-40381)
(AD-A010092; MRC-TSR-1446) Avail: NTIS CSCL 12/1

Adjoint relations are characterized for regular or certain singular Nth order differential systems constrained by infinitely many homogenous locally regular side conditions represented by Stieltjes measures. The system is viewed as generating both maximal and minimal operators on appropriate subspaces of the locally integrable functions. The adjoint relations are determined with respect to an arbitrary dual pairing in the sense of R. Arens. GRA

N75-33773# Wisconsin Univ., Madison. Mathematics Research Center.
CARDINAL INTERPOLATION AND GENERALIZED EXPONENTIAL EULER SPLINES
A. Sharma and J. Tzimbalario Mar. 1975 21 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A010089; MRC-TSR-1530) Avail: NTIS CSCL 12/1

Generalized exponential Euler polynomials are used to study cardinal splines S(x) of degree n. Author

N75-33774# Wisconsin Univ., Madison. Mathematics Research Center.
CONNECTION RELATIONS AND BILINEAR FORMULAS FOR THE CLASSICAL ORTHOGONAL POLYNOMINALS
Mourad El-Houssieny Ismail Feb. 1975 19 p refs
(Contract DA-31-124-ARO(D)-462; Grant NSF GP-33897)

(AD-A010093; MRC-TSR-1416) Avail: NTIS CSCL 12/1

It is shown how orthogonality preserving operators can be used to deribe connection and bilinear formulas for orthogonal polynomials. GRA

N75-33775# Harvard Univ., Cambridge, Mass. Aiken Computation Lab.

MARCHING ALGORITHMS FOR ELLIPTIC BOUNDARY VALUE PROBLEMS. 1: THE CONSTANT COEFFICIENT CASE Technical Report, Sep. 1974 - Apr. 1975

Randolph E. Bank and Donald J. Rose Apr. 1975 129 p refs

(Contract N00014-67-A-0298-0034; NR Proj. 044-454)

(AD-A009954; TR-14-75) Avail: NTIS CSCL 12/1

Several new fast direct methods for solving constant coefficient elliptic boundary value problems are presented. The methods make extensive use of the algebraic properties of the modified Chebyshev polynomials (S sub n)(x) and (C sub n)(x), which allow us to obtain operation counts of O(n squared) or O(n squared) (log(base 2)) for solving problems on an nXn grid. The algorithms are shown to be numerically stable by giving a Wilkinson-style error analysis. Previously studied fast direct methods, and shooting and multiple shooting techniques are related to the algorithms. GRA

N75-33776# Wisconsin Univ., Madison. Mathematics Research Center.

AN APPLICATION OF WAZEWSKI'S METHOD TO A NON-LINEAR BOUNDARY VALUE PROBLEM WHICH ARISES IN POPULATION GENETICS Summary Report

C. Conley Feb. 1975 18 p refs

(Contract DA-31-124-ARO(D)-462)

(AD-A010099; MRC-TSR-1444) Avail: NTIS CSCL 12/1

A non-linear boundary value problem is treated using the principle of T. Wazewski. The problem arises in the study of clines in population genetics theory. GRA

N75-33777# Aberdeen Univ. (Scotland).

ASYMPTOTIC PROBLEMS IN GRAPH THEORY Final Technical Report, 1 Dec. 1973 - 30 Nov. 1974

E. M. Wright Nov. 1974 71 p refs

(Grant DA-ERO-591-124-74-G0021)

(AD-A002076) Avail: NTIS CSCL 12/1

An (n,q) graph is one with n nodes and q edges. It is shown that the asymptotic probability that an (n,q) graph is Hamiltonian is the same whether it is labelled or unlabelled. Again the strict probability for the unlabelled case can decrease as q increases in a certain interval, but not for the labelled case. Dr. Sheehan and the author find a general formula for the number of Hamiltonian circuits in a thickly-edged graph; two very special cases of this were known. The use of the Exclusion-Inclusion Theorem to find asymptotic results can be extended more widely than had previously seemed possible. A detailed theory of the appearance of large cycles in large labelled graphs is developed. From this and other results there follows the somewhat paradoxical evolution of the unlabelled graph as the number of edges increases. GRA

N75-33778# Texas Univ., Austin. Dept. of Mathematics.

A BIBLIOGRAPHIC OUTLINE OF SOME APPLICATIONS OF SPLINE FUNCTIONS Interim Report

Larry L. Schumaker 1975 19 p refs

(Grant AF-AFOSR-2598-74; AF Proj. 9749)

(AD-A008727; AFOSR-75-0500TR) Avail: NTIS CSCL 12/1

A discussion of various practical applications of splines in engineering and science along with a list of references where such applications have been made is given. GRA

N75-33779# California Univ., San Diego. Dept. of Mathematics.

COMBINATORIAL INEQUALITIES AND SMOOTHNESS OF FUNCTIONS Interim Report

Adriano M. Garsia 1975 38 p refs

(Grant AF-AFOSR-2088-71)

(AD-A008725; AFOSR-75-0498TR) Avail: NTIS CSCL 12/1

Classes of functions f(X) measurable on a d-dimensional unit cube are discussed along with the conditions they satisfy. The finiteness of 1 sub(psi,p)(f) was used to derive a priori bounds for other important functionals of f, such as its modulus of continuity or other high order norms. Author

N75-33780# Wisconsin Univ., Madison. Mathematics Research Center.

ON THE RELATION OF THE OPERATOR PARTIAL DERIVATIVE WITH RESPECT TO S AND PARTIAL DERIVATIVE WITH RESPECT TO TAU TO EVOLUTION GOVERNED BY ACCRETIVE OPERATORS Technical Summary Report

Michael G. Crandall and L. C. Evans Apr. 1975 37 p refs

(Contract DA-31-124-ARO(D)-462)

(AD-A011020; MRC-TSR-1541) Avail: NTIS CSCL 12/1

Existence theorems for the equation du/dt = Au + f(t), where A is an accretive operator in a general Banach space X, are typically proved by showing that limits of solutions of discrete approximations to the equation exist. Here the estimates required to show this convergence are exhibited as special cases of estimates relating solutions of difference schemes for partial derivative with respect to S and partial derivative with respect to tau exact solutions. Author

N75-33781# National Bureau of Standards, Washington, D.C.

JOURNAL OF RESEARCH OF THE NATIONAL BUREAU OF STANDARDS: B: MATHEMATICAL SCIENCES, VOLUME 78B, NUMBER 4, OCT. - DEC. 1974 Quarterly Report

1974 52 p refs

(COM-74-50458-04; NBS-JRB-78-4-Vol-78B; LC-62-4414) Avail: NTIS MF $2.25; HC available from SOD as C13.22/secB: 78B(4) CSCL 12A

Contents: saddlepoints in P-pivot classes of skew matrices; maximizing the number of spanning trees in a graph with n nodes and m edges; the field of values and spectra of positive definite multiples; automatic computing methods for special functions-part 2-the exponential integral (E sub n)(x). GRA

N75-33782# North Carolina Univ., Chapel Hill. Dept. of Statistics.

SOME INCOMPLETE AND BOUNDEDLY COMPLETE FAMILIES OF DISTRIBUTIONS Interim Report

Wassily Hoeffding Mar. 1975 40 p refs

(Grant AF-AFOSR-2386-72; AF Proj. 9769)

(AD-A010776; Mimeo-Ser-984; AROSR-TR-75-0648) Avail: NTIS CSCL 12/1

Completeness relative to the permutation group was studied along with invariance under permutations. Applications to unbiased estimation and similar tests are discussed. Author

N75-33783# Wisconsin Univ., Madison. Mathematics Research Center.

A QUASI-NEWTON METHOD FOR UNCONSTRAINED MINIMIZATION PROBLEMS Technical Summary Report

K. Ritter Apr. 1975 42 p ref

(Contract DA-31-124-ARO(D)-462)

(AD-A011013; MRC-TSR-1498) Avail: NTIS CSCL 12/1

A method is described for the minimization of a function F(x) of n variables. Convergence to a stationary point is shown without assumptions on second order derivatives. If the sequence generated by this method has a cluster point in a neighbourhood of which F(x) is twice continuously differentiable and has a positive definite Hessian matrix, then the convergence is superlinear. It is shown that under appropriate assumptions n consecutive search directions are conjugate. No computation of second order derivatives is required. GRA

N75-33784# Wisconsin Univ., Madison. Mathematics Research Center.

A SEMILINEAR ELLIPTIC EQUATION IN (L SUP 1) (R SUP N) Technical Summary Report

Philippe Benilan, Haim Brezis, and Michael G. Crandall Apr. 1975 41 p refs

(Contract DA-31-124-ARO(D)-462; Grant NSF GP-38519)

(AD-A010988; MRC-TSR-1526) Avail: NTIS CSCL 12/1

The problem beta (u) - delta u such that f is studied where f epsilon L(1)(R)(N) and beta is a maximal monotone graph in IR with 0 epsilon beta (0). If N greater than or equal to 3, the problem is shown to have a unique solution in the Marcinkiewicz class. If 0 epsilon int beta (IR) and N = 1,2, solutions unique up to a constant are obtained in other classes. Author

N75-33785# North Carolina Univ., Chapel Hill. Dept. of Statistics.
DELTA MODULATION OF THE WIENER PROCESS Interim Report
Elias Masry (Calif. Univ., La Jolla) and Stamatis Cambanis 1975 17 p refs
(Contract N00014-75-C-0652; Grant AF-AFOSR-2386-72; AF Proj. 9769)
(AD-A010772; AFOSR-75-0647TR) Avail: NTIS CSCL 12/1

The analysis of the performance of a delta modulator with a Wiener process input is considered. The mean and the variance of the steady state squared error are derived. In addition, the mean of the steady state error of order four is calculated. It is shown that the behavior of all these moments as functions of the step size delta and the sampling interval T is similar: For each fixed delta, the moments are monotonically increasing in T. More important, for each fixed T, there exists an optimal step size (delta opt) which minimizes each of these moments. It is shown that (delta opt) is a multiple of square root of (T) and that corresponding minimum value of the moments is a multiple of either T or (T squared), depending on the order of the moment. GRA

N75-33786# Wisconsin Univ., Madison. Mathematics Research Center.
THE POTENTIAL OF A LINE SEGMENT Summary Report
K. B. Ranger Apr. 1975 26 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A010783; MRC-TSR-1482) Avail: NTIS CSCL 12/1

Two different integral transformation methods are described for determining the potential of a straight line segment. The potential is found to be continuous with its derivatives everywhere except at the tips of the needle where the first derivatives behave like the inverse square root of distance from a tip. At infinity the potential behaves like a source or point charge. GRA

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DIFFERENCE METHODS FOR BOUNDARY VALUE PROBLEMS WITH A SINGULARITY OF THE FIRST KIND Technical Summary Report
Frank R. DeHoog and Richard Weiss Apr. 1975 80 p refs
(Contract DA-31-124-ARO(D)-462; Grant NSF MPS-72-00381-A01)
(AD-A011015; MRC-TSR-1536) Avail: NTIS CSCL 12/1

The application of certain difference schemes (box, trapezoidal, Euler and backward Euler) to the numerical solution of boundary value problems for nonlinear first order systems of ordinary differential equations with a singularity of the first kind is examined. The solution of the linear eigenvalue problem is also considered. GRA

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Fred D. Crary and J. Barkley Rosser May 1975 176 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A010987; MRC-TSR-1344) Avail: NTIS CSCL 12/1

If one wishes to calculate numerical approximations for the Riemann zeta function in the critical strip, the most efficient procedure presently known is to use the Riemann-Siegel Formula. In the present report, highly accurate approximations for the primary coefficients appearing in this formula are given. GRA

N75-33789# Harvard Univ., Cambridge, Mass. Aiken Computation Lab.
MARCHING ALGORITHMS FOR ELLIPTIC BOUNDARY VALUE PROBLEMS. 2: THE NON-CONSTANT COEFFICIENT CASE Technical Report, Sep. 1974 - May 1975
Randolph E. Bank 28 May 1975 64 p refs
(Contract N00014-75-C-0243; NR Proj. 044-454)
(AD-A011106; TR-16-75) Avail: NTIS CSCL 12/1

The marching and generalized marching algorithms of Part I are extended to non-constant coefficient problems in which the elliptic operator is separable, once a suitable set of polynomials, which play a role analogous to the Chebyshev polynomials in the constant coefficient case, has been determined. These methods require O(n sup 2) and O(n sup 2 log n/k) operations, respectively, to solve a problem on an n x n grid, and have numerical stability characteristics similar to their constant coefficient counterparts. Problems in which the elliptic operator is not separable are treated using a D'Yakanov-Gunn iteration in which a sequence of separable problems is solved. The rate of convergence of this iteration is shown to be essentially independent of n. GRA

N75-33790# Carnegie-Mellon Univ., Pittsburgh, Pa. Graduate School of Industrial Administration.
BOUNDS ON ABSORPTION PROBABILITIES FOR THE M-DIMENSIONAL RANDOM WALK
Thomas E. Morton and William E. Wecker (Chicago Univ., Ill.) Apr. 1974 18 p refs
(Contract N00014-67-A-0314-0007; NR Proj. 047-048)
(AD-A010549; RR-343) Avail: NTIS CSCL 12/1

Simple procedures are given for computing an upper bound on the probability that an m-dimensional random walk has not been absorbed by step n. The increments of the walk are distributed independently, but not necessarily identically. The upper bound may be computed without knowledge of the means of the increment, the shapes of the nonabsorbing regions, or the starting point of the walk. The absorbing regions may also change with time. Under certain conditions the upper bound is shown to be a geometrically decreasing sequence. Computational examples are given. An application to convergence of the Eppen-Fama stochastic cash balance problem in horizon length is suggested. GRA

N75-33791# Pennsylvania State Univ., University Park. Applied Research Lab.
NUMERICAL INTEGRATION OF CERTAIN IMPROPER INTEGRALS WITH COMPLEX INTEGRANDS M.S. Thesis
R. E. Sheridan, Jr. 6 Feb. 1973 42 p refs
(Contract N00017-70-C-1407)
(AD-A011090; TM-73-19) Avail: NTIS CSCL 12/1

In theoretical fluid mechanics, there is a class of problems associated with calculating the unsteady lift over a row of turbomachine blades that has for its solution a rather complicated function. This function consists of improper integrals whose integrands themselves are complex functions. These integrals cannot be directly evaluated, but previous investigators have successfully integrated them using approximate numerical methods. However, these numerical techniques proved to be inefficient and required substantial amounts of computer time. This report investigates some of the mathematical properties of these integrals and presents a numerical algorithm based upon the Gauss-Legendre method. The Gauss-Legendre scheme proved to be 3.7 times faster than Simpson's rule and the results obtained from the two methods were in good agreement. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N75-33792 Rochester Univ., N.Y.
ON CONCEPTS OF DEPENDENCE FOR MULTIVARIATE DISTRIBUTIONS Ph.D. Thesis
Moshe Shaked 1975 169 p
Avail: Univ. Microfilms Order No. 75-22778

A survey is presented of the developments in the concepts of dependence for multivariate distributions. The various notions that are known in the recent literature are introduced, and the applications of the theory in several fields of probability are indicated. Results of the investigation are presented and discussed. Dissert. Abstr.

N75-33793 Clemson Univ., S.C.
ESTIMATION OF SELECTED PARAMETERS IN NONHOMOGENEOUS POISSON PROCESSES Ph.D. Thesis
Douglas Edwin Huffman 1975 68 p
Avail: Univ. Microfilms Order No. 75-22090

A nonparametric approach is used to find estimates of certain parameters in nonhomogeneous Poisson processes. The approach

is nonparametric because the intensity function is not assumed to have a particular functional form. The sampling procedure used is to observe a random sample of size k of the process on the interval [0,T], where T is a fixed positive constant. To motivate the procedures used to estimate the intensity function, the Rao-Blackwell estimate of the mean value function is given. Three possible estimates of the intensity function are given, and asymptotic properties are obtained for each. Three possible solutions to the peak rate problem are offered, and again asymptotic properties are obtained for each. Finally, estimates for the mean and for the population quantiles of a related density function are obtained. Dissert. Abstr.

N75-33794 Illinois Univ., Chicago.
PARTITIONING A DISTRIBUTION IN ONE OR TWO DIMENSIONS Ph.D. Thesis
Shyam Johari 1975 43 p
Avail: Univ. Microfilms Order No. 75-23358

Suppose that it is described to partition a univariate distribution into k groups (classes) using squared error or absolute error as the measure of information retained. An algorithm to obtain the optimal boundaries (or class probabilities) is given. Optimal class probabilities are given for k = 2 to 15 for beta (for various values of the parameters), chi-square (12 degrees of freedom), exponential, normal and uniform distributions, for the case of squared error. Results obtained are compared and analyzed in light of existing papers. The problem of partitioning a bivariate normal distribution into k groups using squared error as the measure of information retained is also considered. One way of formulating this mathematically is given and the results so obtained are discussed. Problems of partitioning subject to loss functions incorporating both squared error and a cost associated with the number of classes are considered. Dissert. Abstr.

N75-33795*# Federal City College, Washington, D.C. Mathematics Dept.
[STATISTICAL DISTRIBUTION SAMPLING]
Elgy S. Johnson [1975] 18 p refs
(Grant NsG-5003)
(NASA-CR-119145) Avail: NTIS HC $3.25 CSCL 12A

Determining the distribution of statistics by sampling was investigated. Characteristic functions, the quadratic regression problem, and the differential equations for the characteristic functions are analyzed. F.O.S.

N75-33796# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
ON COVARIANCE STRUCTURES Technical Interim Report
P. R. Krishnaiah and Jack Chao-Shing Lee Apr. 1975 31 p refs
(AF Proj. 7071)
(AD-A011593; ARL-75-0103) Avail: NTIS CSCL 12/1

In this report, the authors consider the problem of testing the hypothesis that the covariance matrix of the multivariate normal distribution has certain structure. Under certain conditions, the problem is basically reduced to the problem of testing for the multiple independence of several sets of variables and the equality of the covariance matrices within several batches of populations. GRA

N75-33797# Pennsylvania State Univ., University Park. Applied Research Lab.
A THEORETICAL INVESTIGATION OF A METHOD FOR ANALYZING RANDOM SIGNALS
R. O. Rowlands 7 May 1975 26 p refs
(Contract N00017-73-C-1418)
(AD-A010208; TM-75-150) Avail: NTIS CSCL 09/4

The zero crossings of random noise can be divided into two types, corresponding to the forward and backward rotation of a complex vector whose real and imaginary parts are the noise signal and its Hilbert transform. The statistics of the two kinds of crossing are being investigated to see how well a detection system, based upon measurements of the two kinds of crossings, can determine the presence of a non random signal in a Gaussian noise environment. A formula for the probability that the vector is rotating backwards at any fixed line had previously been used. A rigorous derivation of a more general version of this formula has now been obtained. GRA

N75-33798# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Statistics.
THE JOINT DISTRIBUTION OF PEARSON'S X-SQUARED STATISTICS WHEN MAXIMUM LIKELIHOOD ESTIMATED ARE USED
Donald R. Jensen 1 Dec. 1974 24 p refs
(Contract N00014-72-A-0136-0003; NR Proj. 042-292)
(AD-A002241; VPI-RR-10) Avail: NTIS CSCL 12/1

Limiting joint distributions are studied in Pearson's tests for goodness of fit when parameters are estimated from the original data before grouping. The joint distribution is bounded in terms of distributions appropriate when the parameters are known or are estimated from grouped data. The several distributions are characterized in the limit in terms of partitioned Wishart matrices of unit rank having parameters as appropriate. GRA

N75-33799# Kentucky Univ., Lexington. Dept. of Statistics.
ASYMPTOTIC NORMALITY AND EFFICIENCY OF A CLASS OF TEST STATISTICS
Z. Govindarajulu Dec. 1974 37 p refs
(Contract N00014-73-A-0385-0001; Grant AF-AFOSR-741-65; NR Proj. 042-295)
(AD-A010191; TR-81; TR-10-ONR) Avail: NTIS CSCL 12/1

A new class of two-sample test statistics is defined. Sufficient conditions for its asymptotic normality under a broad class of alternatives are obtained. Asymptotic efficiencies relative to the parametric competitors for shift in location and change of scale are also obtained. These results are extended to the situations where the sample sizes are random and the observations come in pairs and each pair has the same but unknown bivariate distribution. As a particular case, the asymptotic normality of the Spearman's rank correlation coefficient is established in Section 5 under all alternatives. In a straight forward manner the two-sample results are extended to the c-sample case and the asymptotic efficiency of the test criterion, in order to test for the equality of the underlying distributions is evaluated when the alternatives involve shifts in location parameters or changes in scale parameters. GRA

N75-33800# Illinois Univ., Urbana. Dept. of Computer Science.
MOLECULAR STOCHASTICS: A STUDY OF DIRECT PRODUCTION OF STOCHASTIC SEQUENCES FROM TRANSDUCERS Ph.D. Thesis
James Roland Cutler Apr. 1975 88 p refs
(Contract N00014-67-A-0305-0024)
(AD-A010910; UIUCDCS-R-75-723) Avail: NTIS CSCL 14/2

Molecular stochastics is an extension of stochastic computing. The main concern of Molecular Stochastics is the generation of stochastic sequences that are used as the encoded information in stochastic computing. Also, these stochastic sequences in order to have meaning should be dependent upon some physical parameter of interest such as temperature. Thus, the problem is constructing a transducer which outputs a stochastic sequence that varies with respect to a physical parameter. The paper presents the necessary theory along with a discussion of a number of noise sources. These sections imply a number of transducers which were constructed and tested. The data was then compared with the result predicted by the theory. GRA

66 SYSTEMS ANALYSIS

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Shyam Johari 1975 43 p
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(AD-A010910; UIUCDCS-R-75-723) Avail: NTIS CSCL 14/2

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66 SYSTEMS ANALYSIS

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N75-33801 New Mexico Univ., Albuquerque.
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Paul Henry Merritt 1974 213 p
Avail: Univ. Microfilms Order No. 75-18638

The following generalized problem was investigated: given a system that can be described by a vector differential equation

in which the time rate of change of the vector x is a function of the vector x, u, and a, and the scaler t, and given both input data, the vector u, and output data vector x, determine both the general form of the differential equation, the functions, and the unknown parameter, vector a. A method is described for identifying the parameters of the equation. The method was shown to be applicable for use with transient data and demonstrated with a real test of a servocontrolled gyroscope. Extensions to random excitation were considered. Dissert. Abstr.

N75-33802# Waterloo Univ. (Ontario). Dept. of Electrical Engineering.
AN ALGORITHM FOR DECOUPLING MULTIVARIABLE SYSTEMS
P. K. Kar and J. D. Aplevich Nov. 1973 21 p refs Submitted for publication
(Grant NRC-A-7380)
(UWEE/73.8) Avail: NTIS HC $3.25

An algorithm to test the decouplability of multivariable time-invariant linear systems is presented. The result of the algorithm is a canonical form for decouplable systems. From an examination of this form, feedback matrices can be obtained for decoupling the system while assigning a certain number of poles. Author

N75-33803# National Physical Lab., Teddington (England). Div. of Computer Science.
THE EFFECT OF LINK ERRORS AND OF SELECTIVE UPGRADING OF LINK AND NODE SPEED ON NETWORK PERFORMANCE
W. I. Price and G. W. Cowin Sep. 1974 15 p refs
(NPL-Com-76) Avail: NTIS HC $3.25

A model to simulate a packet-switched data network in such a way that it could be easily converted to operate in an isarithmic mode is described. This model includes a link error procedure the function of which is to prevent a proportion of packets determined on a statistical basis from entering the node. A new parameter, giving the common bit error rate for all links, is included in the simulation data. In order to study the effect of component upgrading on network performance it was necessary to upgrade components on a selective basis; all changes were expressed as alterations in the simulation data. All experimental work on component upgrading was carried out with three different random number streams for each set of parameters. It was shown that complete upgrading of the network produces improvements in measured delays at all traffic loads. Improvements in performance were obtained by upgrading a critical link or a pair of critical modes. Small reductions in performance are produced by upgrading components adjacent to nonupgraded critical components. ESA

N75-33804# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
DISCOUNTING, ERGODICITY, AND CONVERGENCE FOR MARKOV DECISION PROCESSES
Thomas E. Morton and William E. Wecker Jan. 1975 46 p refs Sponsored in part by ONR Prepared in cooperation with Chicago Univ.
(AD-A009264; RR-357; WP-20-74-75) Avail: NTIS CSCL 12/2

It was shown that, for the stationary finite state space compact action space Markov decision problem, the relative cost function converges as the product (alpha times lambda) to the power n, where alpha is the discount rate and lambda is between 0 and 1; it was also demonstrated that lambda equals the argument of the subdominant eigenvalue of the optimal infinite horizon policy. Easily obtained bounds for lambda are also given. Under certain additional restrictions policy convergence is shown to be of the same order as relative cost convergence. The same result gives convergence properties for the undiscounted problem and for the case alpha larger than 1. It is further shown that convergence is not in general faster than geometric with the factor alpha times lambda. The methodology seems applicable to the compact state space case. Y.J.A.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N75-33805 Minnesota Univ., Minneapolis.
HYPOTHESIS TESTING PROBLEMS IN THE GENERAL MANOVA MODEL Ph.D. Thesis
Takeaki Kariya 1975 177 p
Avail: Univ. Microfilms Order No. 75-21057

The problem is analyzed using the invariance principle. An essentially complete class theorem that a part of a maximal invariant can be eliminated is proven. An alternative test to the tests proposed so far is proposed, and it is shown to be a unique locally best invariant test (hence admissible in the class of all fully invariant tests) and to be locally minimax. The null and nonnull limiting distributions of the test statistic are derived, and the test is shown to be consistent. A monotonicity property of the power function is considered in a restrictive form. With a restrictive size condition, the test is unbiased. It is also shown that in a special case the LRT (or equivalently the related tests) is a unique UMPI test in a subclass of fully invariant tests as in the Hotelling T squared problem. Dissert. Abstr.

N75-33806 Southern Methodist Univ., Dallas, Tex.
BIVARIATE GAMMA DISTRIBUTIONS AND THE ESTIMATION OF PARAMETERS Ph.D. Thesis
Erwin Manion Hearne, III 1975 99 p
Avail: Univ. Microfilms Order No. 75-22479

Three bivariate gamma density functions are derived. Bivariate gamma distributions are applicable to curve-fitting problems for two-dimensional skewed distributions. A method of moments estimation procedure is presented for these distributions, and the problems associated with maximum likelihood estimation are discussed. Approximate formulae for the variances and biases of the moment estimators for two of the three distributions discussed are obtained. A simulation study on the computer is used to evaluate the estimators and the approximate variances and biases. In light of the results from the simulation study, it appears that an alternate estimation of parameters procedure is needed for these bivariate gamma distributions. Although the density functions are in the form of infinite series, these series converge rapidly. Therefore, an iterative maximum likelihood estimation procedure is an appealing, possible alternative.
Dissert. Abstr.

N75-33807 Pittsburgh Univ., Pa.
AN EVALUATION OF FISHER'S LINEAR DISCRIMINANT FUNCTION AND THE LINEAR LOGISTIC FUNCTION IN CLASSIFICATION USING BINARY VARIABLES Ph.D. Thesis
Ellen Snader BeGole 1975 64 p
Avail: Univ. Microfilms Order No. 75-22429

Two discrimination models, Fisher's linear discriminant function and the separate sample logistic function are compared with respect to the total probability of misclassification when used on various five variable sets of artificial data. Populations are constructed by specifying a set of mean values for each of two populations. A table of random numbers is used to generate the binary values for the observation vectors. In total, 21 experiments are carried out, and the data are analyzed using discriminant and logistic analysis. A classification matrix results from each analysis, and from these matrices, total probability of misclassification is calculated for each of the models under consideration. Results of these computer experiments suggest that it makes little difference which of the two linear functions are used for classification when populations of the types constructed for this study are under consideration.
Dissert. Abstr.

N75-33808 Rice Univ., Houston, Tex.
THE COMPUTATION OF OPTIMAL CONTROLS IN THE PRESENSE OF NONDIFFERENTIAL CONSTRAINTS BY A SEQUENTIAL CONJUGATE GRADIENT-RESTORATION TECHNIQUE Ph.D. Thesis
James Robert Cloutier 1975 61 p
Avail: Univ. Microfilms Order No. 75-22006

An algorithm was developed to solve optimal control problems

involving a functional I subject to differential constraints, terminal constraints, and nondifferential constraints. The algorithm is composed of a sequence of cycles, each cycle consisting of two phases, a conjugate gradient phase and a restoration phase. The conjugate gradient phase involves a single iteration and is designed to decrease the value of the functional while satisfying the constraints to first order. During this iteration, the first variation of the functional I is minimized subject to the linearized constraints and linearized boundary conditions. The restoration phase involves one or more iterations and is designed to restore the constraints to a predetermined accuracy while minimizing the norm of the variations of the control and the parameter. To achieve this constraint satisfaction, quasilinearization (Newton's method) is employed. To facilitate numerical integrations, the intervals of integration is normalized to unit length.

Dissert. Abstr.

N75-33809# Illinois Univ., Urbana. Coordinated Science Lab.
CONVEX HULLS OF FINITE PLANAR AND SPATIAL SETS OF POINTS
F. P. Preparta and S. J. Hong Apr. 1975 26 p refs
(Contract DAAB07-72-C-0259)
(AD-A011024; R-682; UILU-ENG-75-2217) Avail: NTIS CSCL 12/1

The convex hulls of planar and spatial sets of n points can be determined with O(n lg n) operations. The presented algorithms use the divide and conquer technique and recursively apply a merge procedure for two nonintersecting convex hulls. It is also shown that any convex hull algorithm requires at least O(n lg n) operations, so that the time complexity of the proposed algorithms is optimal within a multiplicative constant. GRA

N75-33810# RAND Corp., Santa Monica, Calif.
A FRACTIONAL HYPERCUBE DECOMPOSITION THEOREM FOR MULTIATTRIBUTE UTILITY FUNCTIONS
Peter H. Farquhar Nov. 1974 53 p refs
(AD-A010973; P-5322) Avail: NTIS CSCL 12/2

This paper establishes a fundamental decomposition theorem in multiattribute utility theory. The methodology uses fractional hypercubes to generate a variety of attribute independence conditions that are necessary and sufficient for various decompositions: the additive, Keeney's quasi-additive, Fishburn's diagonal, and others. The paper defines a fractional hypercube and introduces the corresponding multiple element conditional preference order. The main theorem is produced from the solution of equations which are derived from transformations of linear functions that preserve these conditional preference orders. The computations and scaling required in implementing the main result are demonstrated by obtaining four utility decompositions on three attributes: apex, diagonal, quasi-pyramid, and semicube. The methodology is illustrated with geometric structures that correspond to the fractional hypercubes. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N75-33811 Polish Academy of Sciences, Warsaw.
FINDING SYMMETRICALLY EXCITED FIELDS IN CYLINDRICAL LOSS SYSTEMS [ZNAJDOWANIE POL WZBUDZANYCH SYMETRYCZNIE W STRATNYCH UKLADACH CYLINDRYCZNYCH]
Bozena Jaskorzynska-Dzieciaszek 27 Feb. 1975 25 p refs In POLISH
Avail: Issuing Activity

It is shown that each of the components of an excited field in the given symmetric structure independently satisfies the Maxwell equation and boundary conditions, as well as the discrete part of the field made up of damped components which can propagate in such a structure. Expressions are presented for the excited field in the same structure using the Leontowicz approximation. Distribution of the excited field with magnetic current loop in a cylinder with conductive walls is discussed along with electromagnetic signals within cylindrical bodies.

Transl. by M.J.S.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N75-33812*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACOUSTICS OF ATTACHED AND PARTIALLY ATTACHED FLOW FOR SIMPLIFIED OTW CONFIGURATIONS WITH 5:1 SLOT NOZZLE
U. VonGlahn and D. Groesbeck 1975 21 p refs Presented at 19th meeting of The Acoustical Society of America, San Francisco, Calif., 4-7 Nov. 1975
(NASA-TM-X-71807; E-8497) Avail: NTIS HC $3.25 CSCL 20A

The acoustics of simple engine over-the-wing configurations, with complete and partially attached jet flow to the shielding surface were studied with scale models. The nozzle used consisted of a 5:1 slot nozzle operated at a nominal jet Mach number of 0.6, with the flow directed parallel to and at angles up to 10 deg toward the shielding surface. The flow field at the trailing edge of each nozzle/surface configuration was mapped. the results indicate that, with attached flow, the jet flow field is stretched in the flow direction resulting in locally higher velocities than those for partially attached flow or nozzle only flow. The stretching of the flow field increases the noise levels for the attached flow cases compared to those with only partially attached flow. With attached flow, the shielding benefits are substantially reduced compared with fully detached flow. Author

N75-33813# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
THE USE OF COMPUTER-GENERATED PICTURES TO EXTRACT INFORMATION FROM UNDERWATER ACOUSTIC TRANSFER FUNCTION DATA
Gerald N. Cederquist Apr. 1975 206 p refs
(Contract N00014-75-C-0174)
(AD-A010229; UMICH-013514-1; TR-227) Avail: NTIS CSCL 20/1

A fundamental block to the experimental measurement of the time-varying transfer function of an underwater acoustic channel has been the inability of the scientist to cope with the necessarily detailed and hence large amount of data involved. This research shows that computer-generated pictures are one key to solving this data deluge problem. Data display techniques are developed to scan large amounts of multifrequency, bandpass, underwater acoustic transfer function data in the form of computer generated pictures. Transformations are defined to reveal regions of interest as peaks and edges in the pictures. Thus an observer can follow these regions both in frequency and in time, gaining insights into propagation which is impossible to glean from single-frequency data. In addition, the techniques permit easy separation of propagation variations due to low signal-to-noise ratio from variation due to oceanographic effects. These display techniques, applied to transfer function data collected in the straits of Florida, reveal new insights into underwater acoustic propagation in this locale. GRA

N75-33814# Centre National d'Etudes Spatiales, Toulouse (France).
MICROWAVE ACOUSTIC COMPONENTS [COMPOSANTS ACOUSTIQUES MICRO-ONDES]
Marc Orgeret and Jacques Sombrin Jun. 1975 46 p In FRENCH; ENGLISH summary
(CNES-NT-17) Avail: NTIS HC $3.75

A state-of-the-art review of microwave acoustic devices in France is presented. The basic principles of elastic wave propagation in solids (piezoelectric or not) is recalled together with the conversion of electromagnetic waves into acoustic waves. Performance degradations are discussed with regard to insertion losses, propagation and diffraction losses, parasitic signals, and temperature sensitivity. Various components are described, including: delay lines of various types, bandpass filters, phase filters with application to encoders-decoders and matrix computation, programmable transversal filters, directive couplers, amplifiers, correlators, photo acoustic devices (image readers with

acoustic sweep), memory devices, oscillators. Future applications for space applications are discussed. ESA

N75-33815# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
SIMULATION OF A TRAVELLING SONIC BOOM IN A PYRAMIDAL HORN
James Joseph Gottlieb Jul. 1974 231 p refs
(Grant AF-AFOSR-2274-72; AF Proj. 9783)
(AD-A010488; UTIAS-196; AFOSR-75-0711TR) Avail: NTIS CSCL 20/1

In order to assess current societal problem associated with the sonic boom, a horn-type simulator was constructed at the Institute for Aerospace Studies, University of Toronto (UTIAL). The simulator horn is in the form of a horizontal concrete pyramid, which is 25 m long and has 3-m-square base. At its apex a specially-designed value is used to control the mass-flow rate of air from a high-pressure reservoir into the horn where the flow generates a simulated sonic boom or travelling N-wave of suitable amplitude and duration, and acceptably-short rise time. Alternatively, a shock-tube driver can be installed at the apex and used for generating short-duration and rapid rise-time sonic booms. For the mass-flow valve mode of operation of high-frequency sound absorber can be installed near the apex of the horn to filter out of the passing N-wave undesirable jet noise that is produced by the high-speed turbulent flow at the valve. GRA

N75-33816# Westinghouse Research Labs., Pittsburgh, Pa.
PARAMETRIC SCALING LAWS. PART 2: A COMPUTER MODEL FOR DERIVING THE PERFORMANCE CHARACTERISTICS OF SATURATION-LIMITED PARAMETRIC SONARS Final Report, 1 Feb. - 31 Jul. 1974
F. H. Felon and J. W. Kesner 26 Aug. 1974 122 p refs
(Contract N00014-74-C-0214; ARPA Order 2655)
(AD-A001122; Rept-72-9M7-NONLN-R3) Avail: NTIS CSCL 17/1

This report outlines the procedures used in a computer program for calculating the performance characteristics of saturation-limited parametric transmitters and receivers. The program enables the amplitude and frequency response of such sonars to be evaluated including the amplitude dependence of their far field beam patterns and directivity indices. GRA

N75-33817# Georgetown Univ., Washington, D.C. Dept. of Physics.
EFFECTS OF LAMB WAVES ON ULTRASONIC BOUNDED BEAM PROPAGATION Ph.D. Thesis. Technical Report, 1 Mar. - 31 May 1975
Thomas J. Plona 31 May 1975 122 p refs
(Contract N00014-75-C-0333; NR Proj. 307-352)
(AD-A010881; GUUS-05753; TR-3) Avail: NTIS CSCL 20/1

Schlieren techniques are used to show that non-specular reflections of bounded sonic beams occur from a solid-plate/water interface when a Lamb mode of the solid plate is excited by the incident sonic beam impinging at a Lamb angle. The resulting change in the profile of the reflected beam is measured and compared to predictions based on theory. GRA

N75-33818# Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.
VERTICAL DIRECTIONALITY OF NOISE AND SIGNAL TRANSMISSIONS DURING OPERATION CHURCH ANCHOR Summary Report
Victor C. Anderson 15 Nov. 1974 56 p refs
(Contract N00014-69-A-0200-6002; NR Proj. 260-103)
(AD-A011110; SIO-Ref-75-1; MPL-U-53/74) Avail: NTIS CSCL 20/1

A vertical array of 20 vibration isolated hydrophones was suspended from the Research Platform FLIP at various depths from 713m to 4816m. Preformed sets of beams were formed with a digital beamformer to observe the vertical noise distribution at three to four frequencies between 20 and 100 Hz. Directional spectra derived from 10 minutes samples of digital records are presented. Several contour plots of amplitude distributions are also shown for both signal and noise records. GRA

N75-33819# Naval Research Lab., Washington, D.C.
THE MEASUREMENT OF SMALL WAVEFRONT DEVIATIONS INTRODUCTED BY A PANEL Interim Report
J. L. Lastinger and R. F. Green 10 Jun. 1975 13 p
(AD-A011035; NRL-7908) Avail: NTIS CSCL 17/1

Wavefront deviation of a low-frequency sound beam introduced by passage of the beam through a rubber panel was measured at angles of incidence from 0 to plus or minus 20 deg. The technique of measurement is described, and results and measurement problems are discussed. Resolution of the measurements is estimated as 0.01 deg, but this value probably can be improved to 0.001 deg by incorporating the changes described. GRA

N75-33820# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DESIGN FEATURES OF THE SUBMERSIBLE MODULAR ACOUSTIC SYSTEM
Paul T. McElroy Mar. 1975 37 p refs
(Contract N00014-75-C-0659; NR Proj. 260-113)
(AD-A010545; BBN-3060) Avail: NTIS CSCL 17/1

The submersible modular acoustic system is a general-purpose acoustic measurement intended for use on the submersible ALVIN. It is presently nearing completion. This report gives a description of the system and its components to serve as an aid in designing experiments and to provide the instrumental basis for a series of experiments to be discussed in later reports. Other acoustic items which are available for use on ALVIN are listed, as are other submersible instruments which might profitably be used with this acoustic tool. GRA

N75-33821# Pennsylvania State Univ., University Park. Applied Research Lab.
BACKSCATTERING AND DIFFRACTION FROM BARE AND LINED WEDGES: THEORY AND EXPERIMENTS
Alan D. Stuart and Susan M. Cohick 25 Feb. 1974 47 p refs
(Contract N00017-73-C-1418)
(AD-A011092; TM-74-39) Avail: NTIS CSCL 14/2

This report documents an experimental program to determine the ability of existing theoretical formulations to predict the acoustic diffraction field from submerged wedges. Both backscatter and diffraction measurements were conducted on two wedges measuring 75 and 90 degrees. Tests were conducted on the bare steel wedges and on the wedges lined with a pressure release rubber. The experimental results were compared to the fiber order approximation of the diffraction field from rigid and pressure release wedges. The experimental values for the bare steel and rubber lined wedges agree to within experimental error. This combined value agrees more closely with the pressure release wedge theory than with the rigid wedge theory. GRA

N75-33822# Raytheon Co., Portsmouth, R.I. Submarine Signal Div.
APPLICATIONS OF PARAMETRIC SONAR TO UNDER-ICE OPERATIONS, VOLUME 2 Final Report
D. L. Bell, L. C. Britton, and W. J. Porter 25 Apr. 1975 80 p
(Contract N00024-74-C-1060)
(AD-A010552) Avail: NTIS CSCL 17/1

The report describes an investigation concerning parametric sonar applications to under-ice operations. Two basic tasks are undertaken. These are first, a data gathering program in an environment which partially simualtes the under-ice environment; and second, a theoretical investigation which extrapolates the results obtained to the under-ice environment. To gather data in a representative environment, a parametric sonar operating in a sub-bottom profiling mode was used in a downward looking mode analogous to upward scanning of the water to sea-ice interface. Results were analyzed and compared to possible under-ice operations in the theoretical investigations. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N75-33823 Catholic Univ. of America, Washington, D.C.
QUANTUM ELECTRODYNAMICS OF ONE- AND TWO-PHOTON RADIATION AND MOLECULAR INTERACTION. PART 1: NOVEL TWO-PHOTON RADIATIVE INTERACTION OPERATORS FROM RELATIVISTIC THEORY FOR RAYLEIGH SCATTERING AND FOR SPIN-DEPENDENT FARADAY ROTATION. PART 2: QUANTUM FIELD INTERACTION AND COOPERATIVE RADIATIVE TRANSITION BY COMPOSITE SYSTEMS Ph.D. Thesis
Samuel Heffner Brown, Jr. 1975 72 p
Avail: Univ. Microfilms Order No. 75-21533

The quantum field theoretic treatment of Akhiezer and Berestetskii is generalized to a Dirac electron in a time dependent electromagnetic field. From the Hamiltonian a unique set of Hermitian, time dependent, interaction operators applicable to two-photon, as well as one photon, processes are obtained. The radiative process involving two interacting systems is studied using the third order S matrix theory. A rigorous evaluation of the two resulting third order Feynman diagrams from quantum electrodynamics in the nonrelativistic limit is performed. After the third order S matrix is reduced to the U matrix, this evaluation produces new field field interaction transition operators which are two electron operators and are different from those obtained earlier by Chiu by a conventional method. Dissert. Abstr.

N75-33824# Army Electronics Command, Fort Monmouth, N.J.
ALUMINUM THRESHOLD DOSIMETRY AT THE ECOM 14-MeV NEUTRON IRRADIATION FACILITY
Stanley Kronenberg, Harry Berkowitz, Robert Pfeffer, and Robert A. Lux May 1975 15 p refs
(AD-A010334; ECOM-4323) Avail: NTIS CSCL 18/4

An aluminum threshold dosimetry technique has been adopted to measure neutron fluences at the Fort Hancock 14-MeV neutron source operated by the ECOM Nuclear Radiation Facility. A procedure is outlined for those wishing to measure dose delivered to irradiated samples. A description of the source (including its calibration) is provided, as is a theoretical clarification of the dosimetry technique. GRA

N75-33825# Avco-Everett Research Lab., Everett, Mass.
OPTICAL INTERFERENCE PHENOMENON Final Report
C. W. VonRosenberg, Jr. and Daniel W. Trainor 20 Feb. 1975 28 p refs
(Contract DNA001-72-C-0007; ARPA Order 1433; DNA Proj. NWED-QAXH-I002)
(AD-A009942; DNA-3568F) Avail: NTIS CSCL 07/4

The authors previously reported a number of results from studies of IR emission from nascent ozone formed by the three body recombination O + O2 + M to O3(+) + M (M = O2, N2). In the present program, they extended these results by looking for emission from the (101) combination band (4.7 micrometers) and by looking for evidence of the excited (but bound) triplet state predicted by recent theoretical efforts. They justified the assumption of either equal quantum efficiencies of excitation for nu1 and nu3 or rapid V-V coupling between them. Experimentally, emission was sought both from nu1 and nu3 vibration/rotation transitions of the excited electronic states (1-0 transitions predicted), and from the (forbidden) triplet to singlet electronic state transitions. GRA

N75-33826# Pittsburgh Univ., Pa. Atomic Sciences Inst.
ATOMIC AND MOLECULAR PROCESSES Technical Progress Summary Report No. 18
M. A. Biondi 30 Jun. 1975 18 p refs
(Contract N00014-67-A-0402-0010; ARPA Order 2686)
(AD-A010528) Avail: NTIS CSCL 07/4

The report briefly discusses progress in the areas of laser studies, atmospheric radiation backgrounds and infrared detection. GRA

N75-33827# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THE EFFECT OF SEVERAL CONFIGURATION INTERACTION TARGET STATES ON THE ELASTIC SCATTERING OF LOW-ENERGY ELECTRONS BY COMPLEX ATOMS Physical Sciences Research Papers
Ed R. Smith Jan. 1975 25 p refs
(AF Proj. 8627)
(AD-A010421; AFCRL-TR-75-0054; AFCRL-PSRP-625) Avail: NTIS CSCL 07/4

The total wave function (target plus incident electron) is represented by a close coupling expansion. For complex atoms such as atomic helium and oxygen, the effects of configuration interaction target states are discussed and analyzed, in part. For atomic helium, the doublet S partial-wave elastic cross section obtained using a He configuration interaction ground state is virtually identical with the corresponding cross section obtained using a Roothaan-Hartree-Fock ground state. In all cases studied, the elastic phase shift is shown to increase with the addition of atomic states and explicit correlation states into the expansion for the total wave function. For atomic oxygen, the quartet P partial-wave elastic phase shift can increase to such an extent as to introduce a resonance behavior into the low-energy part of the elastic cross section. Finally, a second procedure is discussed for including correlation states when CI target states are used in the close-coupling expansion. GRA

N75-33828# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPTON SCATTERING BY K-SHELL ELECTRONS OF GOLD AND HOLMIUM M.S. Thesis
John W. Woody Mar. 1975 60 p refs
(AD-A010437; GNE/PH/75-15) Avail: NTIS CSCL 07/4

The relative doubly-differential cross section for scattering of 662-keV photons by K-shell electrons was obtained using a Ge(Li) detector. The width of the scattered photon peak was measured and corrections applied to determine the approximate width of the peak due to the energetic motion and binding of the bound electrons. Instrumental and statistical uncertainties provided a significant part of the peak width and the data is not considered to be reliable. The incoherently scattered photons were peaked near the Compton energy for free-stationary electrons. GRA

N75-33829# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ELECTRON CAPTURE FROM Tl(+)(6s2 AND Li(+) BY PROTONS Final Report
Robert A. Mapleton, Marcel F. Schneeberger, and Charles A. Steel, Jr. 28 Jan. 1975 28 p refs
(AF Proj. 8627)
(AD-A010433; AFCRL-TR-75-0053; AFCRL-PSRP-624) Avail: NTIS CSCL 07/4

The impact parameter version of the two-state approximation is used to calculate the cross sections for the two processes, (A) H(+) + Li(+) (1s2) to H(ls) + Li(+2)(ls), (B) H(+) + Tl(+) (6s2) to H(ls) + Tl(+2) (6s). The corresponding differential equations were integrated numerically with and without momentum transfer (mt) for process (A), but owing to the numerical complexity of the equations describing process (B) only the case mt = 0 was evaluated. Cross sections for (A) are compared with and without the inclusion of mt, and similarities between the two processes, (A) and (B), are discussed. The cross-section impact-energy variations for capture from Tl(+) and capture from the neutral atoms Kr and Xe are compared. GRA

N75-33830# Aerospace Corp., El Segundo, Calif. Lab Operations.
ELECTRONIC EXCITATION IN COLLISIONS OF FAST PROTONS AND HYDROGEN ATOMS WITH NO, N2O, CO2, AND OCS Interim Report
John H. Birely and Peter A. Johnson 15 Apr. 1975 21 p refs
(Contract F04701-74-C-0075)
(AD-A010596; TR-0075(9270-01)-7; SAMSO-TR-75-125) Avail: NTIS CSCL 07/4

Analyses of radiation in the 115- to 850-nm range produced by collisions of 10 to 25 keV and H(+) and H with NO, N2O, CO2, and OCS under thin target conditions have been carried out. The most prominent features for the polyatomic targets are emitted by excited parent molecule ions. Except in the case of OCS, for which weak CO(+) bands were detected, the cross sections for dissociative excitation to yield diatomic fragments are extremely small. These observations in conjunction with results obtained elsewhere for other projectile ions provide further evidence that, in the competition among allowed excitation

channels, details of the electronic structure of the collision partners override energy considerations. For an NO target, the NO(+) bands are observed and, for all of the molecules studied, atomic lines resulting from dissociative excitation are prominent in the spectra. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N75-33831# Naval Research Lab., Washington, D.C.
STIMULATED COLLECTIVE SCATTERING FROM A MAGNETIZED RELATIVISTIC ELECTRON STREAM Interim Memorandum Report
P. Sprangle, V. L. Granatstein, and L. Baker Apr. 1975 19 p refs
(NRL Proj. R08-59)
(AD-A010116; NRL-MR-3028) Avail: NTIS CSCL 20/9

The scattering of an electromagnetic pump wave, of frequency (omega sub 0), from a cold relativistic magnetized electron beam is analyzed. The scattered waves consist of collective plasma oscillations as well as electromagnetic waves. The frequency of the scattered electromagnetic wave is doppler shifted up twice and is of order (gamma squared) (omega sub 0). Enhanced growth rates for the scattering process can be obtained by cyclotron resonance effects. GRA

N75-33832# Energy, Inc., Idaho Falls, Idaho.
ANALYSIS OF GE BWR BLOWDOWN HEAT TRANSFER PROGRAM, TEST 4906 (AEC STANDARD PROBLEM FOUR) Final Report
K. V. Moore, C. M. Moser, C. E. Peterson, R. T. Fernandez, and K. A. Nilsson Jan. 1975 78 p refs Prepared in cooperation with Electric Power Research Inst., Inc.
(PB-242397/8; EPRI-280-FR) Avail: NTIS HC $4.75 CSCL 18I

Standard Problem Four is the fourth problem from a series of Loss-of-Coolant Accident (LOCA) problems developed for the evaluation and comparison of computational techniques used to predict the blowdown phase of Light Water Reactors (LWR's) during nonstandard operational conditions. Among the parameters to be calculated are differential pressures at strategic positions, the steam dome pressure, the drive pump speed for the intact recirculation loop, the fluid densities, several mass flow rates, heater rod temperatures, the residual fluid mass remaining in the lower plenum at 45 seconds, and the mixture level in the lower plenum. GRA

N75-33833# Electric Power Research Inst., Palo Alto, Calif.
EPRI PROGRAMS ON PLUTONIUM FUEL UTILIZATION
B. A. Zolotar, M. E. Lapides, and F. E. Gelhaus Feb. 1975 13 p Presented at the Intern. Atomic Energy Agency Panel on Plutonium Utilization in Thermal Power Reactors, Karlsruhe, West Germany, 25-29 Nov. 1974
(PB-242414/1; EPRI-SR-6) Avail: NTIS HC $3.25 CSCL 18J

EPRI has initiated a plutonium recycle program with a goal of providing a technical base for the industry. Basic criteria for Pu recycle will be made by the individual user, subject to United States government requirements. The use of Pu generated during thermal reactor operation will require assessments of several alternatives, including: (1) recycle of Pu in water reactors designed for uranium-bearing cores; (2) recycle of Pu in water reactors specially designed for or adaptable to large-scale Pu usage; (3) use of Pu as a fissile makeup or startup material in present HTGR's, or as the major fuel in an HTGR designed as a Pu burner; (4) storage of spent fuel or recovered Pu; and (5) sale of Pu if a market develops. GRA

N75-33834# Electric Power Research Inst., Palo Alto, Calif. Nuclear Power Div.
THERM: TRANSIENT THERMAL ANALYSIS OF A NUCLEAR FUEL ROD
Rodney R. Gay Mar. 1975 35 p ref
(PB-242415/8; EPRI-SR-7) Avail: NTIS HC $3.75 CSCL 18K

THERM is a finite difference conduction-convection computer program, written in FORTRAN, designed to predict the transient thermal response of a reactor fuel rod and coolant channel to reactivity or flow perturbations. Stability and speed were the most important criteria in its design. THERM consists of six subroutines and a main program. All computational work is done in the subroutines. The major program serves to call in the subroutines in their proper sequence and print out the results. The calculation of the system temperatures in a given time increment in the THERM program proceeds in two distinct steps. GRA

74 OPTICS

Includes light phenomena.

N75-33835*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD AND SYSTEM FOR PRODUCING CHROMA SIGNALS Patent Application
Kenneth Vorhaben (Lockheed Electronics Co., Houston, Tex.) and Phillip C. Lipoma, inventors (to NASA) (Lockheed Electronics Co., Houston, Tex.) Filed 12 Sep. 1975 31 p
(Contract NAS9-12200)
(NASA-Case-MSC-14683-1; US-Patent-Appl-SN-612967) Avail: NTIS HC $3.75 CSCL 20F

Disclosed is a method and system for obtaining electronic chroma signals with a single scanning type image device by optically producing a color multiplexed light signal using an arrangement of dichroic filter stripes. A two layer filter system is used to color modulate external light which is then detected by an image pickup tube. The resulting time division multiplexed electronic signal from the pickup tube is converted by a decoder into a green color signal, and a signal red/blue multiplexed signal, which is demultiplexed to produce red and blue color signals. The three primary color signals are capable of being encoded as standard NTSC color signals. NASA

N75-33836*# Kanner (Leo) Associates, Redwood City, Calif.
BAND GRID FILTERS FOR THE LONG-WAVE INFRARED REGION
N. R. Braverman, L. V. Vorobyev, V. A. Soglasnova, and G. B. Sholomitskiy Washington NASA Oct. 1975 22 p refs Transl. into ENGLISH of "Polosovyye Setochnyye Filtry Dlya Dlinnovolnovoy Ik-Oblast", Rept. Pr-223 USSR Acad. of Sci., Inst. of Space Res., Moscow, 1975 24 p
(Contract NASw-2790)
(NASA-TT-F-16607; Pr-223) Avail: NTIS HC $3.25 CSCL 20F

A technology was developed for making metal fine-structure grid cloth with structure period from 20 to 120 micrometers; their spectral characteristics were studied in the 2.5-300 micrometer region. Openings in the grid cloth are square and round with chessboard and honeycomb arrangement of the round openings. It is shown that when the ratio of opening size to period is optimal, these structures can be used as band infrared filters with transmission maximum at wavelengths lambda sub M of the order of the period. The transmission at the maximum is 70-90 percent; the Q-factor for square openings is about 3, and for round openings, 4-6. Transmission in the short-wave wing at the wavelengths (0.8-0.1) lambda sub M is 10-20 percent, depending on the ratio between openings and period and increases up to the level of geometrical transparency at shorter wavelengths. Additional filter elements must be used to suppress the shortwave radiation. Author

N75-33837# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A FULLY TUNABLE LYOT-OHMAN FILTER Instrumentation Papers
Jacques M. Beckers, Larry Dickson, and Randy S. Joyce 10 Feb. 1975 28 p refs

(AD-A011599; AFCRL-IP-227) Avail: NTIS CSCL 20/6

Properties of the Zeiss universal birefringent filter and its optical and electronic interface with the Sacramento Peak Observatory's vacuum telescope are described. The instrument permits observations of solar intensities, velocities and/or magnetic fields in rapid succession in any Fraunhofer line in the 410 to 700 nm wavelength region with high spectral (0.004 to 9.013 nm) and high spatial (approximately 1/3 arc second) resolution. GRA

N75-33838# Block Engineering, Inc., Cambridge, Mass.

AIRBORNE TRANSMISSOMETER DESIGN STUDY, ANALYTIC DESCRIPTION OF THE ATMOSPHERIC TRANSMISSION PATH Final Report, Jun. 1973 - Feb. 1975

Apr. 1975 49 p refs

(Contract F29601-75-C-0146; AF Proj. 6095)

(AD-A009992; AFSWC-TR-75-42) Avail: NTIS CSCL 20/6

This report identifies a suitable analytic description of the transmission path of the instrument discussed in ADA009991. Integration of data from that instrument into the description of the transmission path is discussed. This results in information with which to derive correction factors for measured sensor responses. GRA

N75-33839# Army Electronics Command, Fort Monmouth, N.J.

STABILIZATION TECHNIQUES FOR VEHICLE MOUNTED OPTICAL SYSTEMS Final Report, Jul. 1973 - Mar. 1975

Thomas C. Hartrum May 1975 53 p refs

(DA Proj. 1T1-61101-A-91A)

(AD-A010330; ECOM-4313) Avail: NTIS CSCL 17/2

An optical communication system requires a very narrow beamwidth to maximize power density at the receiver. When mounted at stationary vehicles, such systems are extremely susceptible to misalignment by wind gusts. In this report a 2 1/2 ton vehicle is modeled on an analog computer to determine stabilization requirements. Various stabilization techniques are considered. A commercial passively stabilized hand-held viewer is modified and tested. The results are discussed and recommendations for future development are presented. GRA

N75-33840# Arizona Univ., Tucson. Optical Sciences Center.

SEMIANNUAL FY75 APPLIED OPTICS RESEARCH REPORT Quarterly Report, 1 Oct. - 31 Dec. 1974

P. A. Franken Jan. 1975 84 p refs

(Contract F04695-67-C-0197)

(AD-A010486; SAMSO-TR-75-112) Avail: NTIS CSCL 20/6

Specifically covered in this report are infrared research, mathematical optics, optical processing, optical tracking, quantum optics, remote sensing and thermal expansion and dimensional stability. Also included is a list of professional publications and activities of Optical Sciences Center personnel. GRA

N75-33841# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

INFLUENCE OF CRYSTAL ANISTROPY ON COMPOSITE WINDOW DESIGN FOR REDUCING THERMAL DISTRIBUTION Interim Report

Bernard Bendow, Peter D. Gianino, Martin Flannery (Univ. of Southern Calif., Los Angeles), and John Marburger (Univ. of Southern Calif., Los Angeles) 15 May 1975 21 p refs Presented at the Proc. of 4th Ann. Conf. on Infrared Laser Window Mater., Tucson, Ariz., Nov. 1974 Submitted for publication

(AF Proj. 3326)

(AD-A010463; AFCRL-TR-75-0276) Avail: NTIS CSCL 20/6

The authors investigate the potential of layered composites and coatings for reducing thermal lensing from laser windows. A generalization of the aberration function formalism of Born and Wolf which accounts for birefringence effects is obtained, and applied to analyze representative 10.6 micrometers window materials. The results indicate the possibility of reduction in aberrations by as much as several orders of magnitude in appropriate cases. It appears likely that crystalline orientation effects can play a crucial role in determining the suitability of composites. GRA

N75-33842# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

A REVIEW OF TECHNIQUES FOR MEASURING SMALL OPTICAL LOSSES IN INFRARED TRANSMITTING MATERIALS

Lyn H. Skolnik 15 May 1975 32 p refs

(AF Proj. 3326)

(AD-A010461; AFCRL-TR-75-0274) Avail: NTIS CSCL 20/6

The authors review some recent developments in techniques for measuring small absorption coefficients in the infrared spectral region. This paper considers thermal methods such as thermocouple, optical and acoustic calorimetry as well as some direct loss techniques including laser differential attenuation measurements and emittance spectroscopy. The various methods are compared on the basis of sensitivity and ease of implementation; advantages and disadvantages of each technique are discussed. Some consideration is given to methods for separating surface, bulk, and scattering losses. GRA

N75-33843# Galileo Electro-Optics Corp., Sturbridge, Mass.

THE 0609 MINIATURE REPORT Final Report

James L. Knak 29 Mar. 1974 47 p refs

(Contract DAAK02-72-C-0651)

(AD-A001979) Avail: NTIS CSCL 17/8

The miniature power supply developed is intended for use on the night vision goggle or pocket scope. The design allows the power supply to be assembled to the tube after the tube has been potted in the plastic sleeve. With this approach the power supply or the tube can be mated with another module without depotting the assembly. The design incorporates Automatic Brightness Control (ABC) and Bright Source Protection (BSP). GRA

N75-33844# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

MID AND FAR INFRARED VIDICON INVESTIGATIONS OF THERMAL LENSING, INTERFERENCE, AND THERMAL RADIATION FROM LASER WINDOWS Interim Report

Lyn H. Sklonik, Bernard Bendow, Peter D. Gianino, and Edward F. Cross (Aerospace Corp., El Segundo, Calif.) Nov. 1973 46 p refs Presented at Conf. on High Power Infrared Laser Window Mater., Hyannis, Mass., 12-14 Nov. 1974

(ILIR Proj. 3I-01)

(AD-A010435; AFCRL-TR-74-0031) Avail: NTIS CSCL 20/6

The authors report results of investigations of lensing and interference effects on the transmission of 10.6 micrometer CW laser beams through material windows. The evolution of the transmitted beam profile is recorded employing a real-time IR Vidicon detection system; observations are carried out on a variety of windows, including Irtran-4, Si, KCl, BaF2 and CsBr. The phenomena observed include lensing, slewing and interference, and combinations thereof. The majority of the observations may be interpreted in terms of existing theoretical models; the slewing effect, however, remains unaccounted for as yet. Also described is a novel technique in which the thermal profile in the window is recorded simultaneously with the transmitted pattern, by employing a GE Vidicon sensitive in the 2.3-4.5 micrometer range to spatially image radiation emitted by the window. The results suggest that scattering and absorption near the periphery of circular samples may be an important mechanism in determining the heat distribution in the window. GRA

N75-33845# Xonics, Inc., Van Nuys, Calif.

THEORETICAL STUDIES OF HIGH-POWER ULTRAVIOLET AND INFRARED MATERIALS Technical Report, 30 Jun. - 6 Dec. 1974

Marshall S. Sparks, Carl J. Duthler, and Carl J. Duther 6 Dec. 1974 225 p refs

(Contract DAHC15-73-C-0127; ARPA Order 1969)

(AD-A009256; TR-4) Avail: NTIS CSCL 20/6

Results are presented of investigations of higher energy laser mirror materials and erosion of infrared windows. Topics discussed include stimulated Raman scattering, enhanced Stokes gain and effects of anti-Stokes and parametric phonon processes, enhanced stimulated Raman scattering and general three-boson parametric instabilities, theory of laser materials damage by enhanced stimulated Raman scattering, surface roughness and the optical properties of a semi-infinite material, the effect of a dielectric overlayer, construction of the Green functions for electromagnetic wave equations, theory of laser heating of solids, current status

of high-intensity vacuum ultraviolet materials, and impurity absorption in halide window materials. Author (GRA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N75-33846 Princeton Univ., N.J.
ACCELERATION PROCESSES IN THE QUASI-STEADY MAGNETOPLASMADYNAMIC DISCHARGE Ph.D. Thesis
Michael John Boyle 1975 137 p
Avail: Univ. Microfilms Order No. 75-23182

The flow field characteristics within the discharge chamber and exhaust of a quasi steady magnetoplasmadynamic (MPD) arcjet are examined to clarify the nature of the plasma acceleration process. An empirical two flow plasma acceleration model is advanced which delineates inner and outer flow regions and accounts for the observed velocity profile and calculated thrust of the accelerator. The acceleration process is characterized by nearly 50% of the total arc current flowing downstream of the anode orifice. The plasma leaves the discharge chamber at a speed of less than 9.0 km/sec and accelerates to 12.5 km/sec several anode orifice diameters downstream. A supersonic expansion in the exhaust plume accounts for the observed plasma acceleration to 12.5 km/sec of the inner flow. Dissert. Abstr.

N75-33847 Polish Academy of Sciences, Warsaw.
THE CONNECTION OF PLASMA RESISTIVITY WITH ELECTRIC FIELD AUTOCORRELATIONS BASED ON THE LANGEVIN EQUATION [ZWIAZEK REZYSTYWNOSCI PLAZMY Z AUTOKORELACJAMI POLA ELEKTRYCZNEGO NA PODSTAWIE ROWNANIA LANGEVINA]
Krzysztof Zuchowski 27 Feb. 1975 20 p refs In POLISH
Avail: Issuing Activity

A Langevin equation modification is discussed which relies more on direct consideration of spatial dispersion than on the generalized Langevin equation. Other topics discussed include fluctuation-dissipation theorems, stability conditions for generalized Langevin equation, response of a system to input force, stochastic autocorrection, tensor resistivity, and tensor friction coefficients. Transl. by M.J.S.

N75-33848# Sandia Labs., Albuquerque, N.Mex.
RELATIVISTIC ELECTRON BEAM HEATING OF A TOKAMAK PLASMA
D. W. Swain, P. A. Miller, and M. M. Widner Jun. 1975 43 p refs
(Contract AT(29-1)-789)
(SAND-75-0214) Avail: NTIS HC $5.25

A theoretical treatment of heating of tokamak plasmas by relativistic electron beam (REB) injection is presented. Comparisons with prior work and considerations for both research and reactor sized systems are included. Guiding center orbits for beam electrons in a tokamak are obtained and requirements for significant beam penetration of the plasma are determined. Interaction mechanisms of the beam with the plasma are reviewed and ion heating and runaway problems are considered. Results indicate that, under a reasonable set of assumptions: (1) the REB can be injected to penetrate into the plasma volume and will be trapped in the plasma; (2) the beam should heat the plasma electrons due to beam-plasma instability or return current heating, and some direct ion heating may occur; and (3) the classical rate of energy transfer from electrons to ions would be great enough in a system satisfying the Lawson condition to convert much of the REB energy to ion energy, in case direct ion heating did not occur. Author (NSA)

N75-33849# Groupe des Recherches Ionospheriques, Paris (France).
HOT PLASMA TEMPERATURE AND ELECTRONIC DENSITY PRECISION MEASUREMENT WITH A DOUBLE SPHERE DIPOLE ANTENNA IN PASSIVE MODE [DETERMINATION DE LA PRECISION AVEC LAQUELLE IL EST POSSIBLE D'OBTENIR LA TEMPERATURE ET LA DENSITE ELECTRONIQUE D'UN PLASMA CHAUD ISOTROPE AU MOYEN D'UNE ANTENNE DIPOLE DOUBLE-SPHERE UTILISEE EN MODE PASSIF]
D. Odero Dec. 1973 23 p refs In FRENCH
(GRI/NTP/120) Avail: NTIS HC $3.25

The behavior of a double sphere dipole antenna imbedded in a hot collisionless plasma is studied. The boundary value problems arriving from finite sphere dimensions are considered. The multiple water back model is used for antenna impedence determination. The relationship of the antenna resistance to fluctuating tension is discussed. Random errors involved for random signals and their incidence on data processing are discussed. A computer program was established to determine the observation time required for a one percent precision on density and temperature in the ionosphere as a function of sphere distance and radius. ESA

N75-33850# Naval Research Lab., Washington, D.C.
RADIATION FROM SOURCES MOVING IN A WARM MAGNETOPLASMA Final Report
Dennis John Baker 10 Apr. 1975 230 p refs
(NRL Proj. R07-30; RF21222401)
(AD-A010827; NRL-7871) Avail: NTIS CSCL 20/9

The power lost through radiation by an electric charge as it spirals in a homogeneous magnetoplasma is calculated. Coherent Cerenkov radiation from a group of charges is studied by assuming the charges radiate as a single macroscopic ellipsoid of revolution having a uniform volume charge density. The total power radiated by such a macroscopic source is shown to be finite even in those cases where the refractive index is unbounded. The power radiated by electric dipole and loop antennas oriented with their axes along the magnetic field of an anisotropic plasma and moving parallel to this field are given in the form of integrals which are easily evaluated numerically. Mathematical models of the plasma dielectric tensor are derived using kinetic theory in addition to using the so-called hydrodynamic and full adiabatic theories (our Model H and A, respectively) with allowances made for the finite temperatures of both ions and electrons. Numerical results obtained using Models A and H are compared. For example, Model A predicts that in some cases a large fraction of the power radiated by a moving point charge source at frequencies near the upper hybrid resonance is in the form of thermal mode excitation. However, this high energy thermal mode is missing from results obtained for the same source charge using Model H. GRA

N75-33851# Dartmouth Coll., Hanover, N.H.
NONLINEAR CONTROL OF TURBULENCE AND VELOCITY SPACE DIFFUSION IN BEAM PLASMA SYSTEMS
J. E. Walsh 6 Jun. 1975 20 p refs Sponsored by ERDA
(COO-3632-27) Avail: NTIS HC $4.00

Results of low energy electron beam-plasma heating experiments are discussed. A figure of merit which can be used to compare different beam heating experiments is presented. Some general observations about the possibility of useful beam plasma heating are mentioned. Author (NSA)

N75-33852# Illinois Univ., Urbana. Coordinated Science Lab.
VIDEO IMAGING ON THE PLASMA DISPLAY PANEL
Andrew Burton White Apr. 1975 84 p refs
(Contracts DAAB07-72-C-0259; N00014-67-A-0305-0021)
(AD-A011023; R-677; UILU-ENG-75-2212) Avail: NTIS CSCL 09/5

The plasma display panel is a versatile bi-level device capable of combining alpha-numerics and graphics in the same display because of its inherent memory and random write and erase feature. The ability to reproduce continuous tone pictures would have several current applications in the area of interactive visual communication systems and computer aided instruction. Many techniques have been suggested to allow gray scale graphics generation on the panel, among them being ordered dither. A review of various gray scale methods and the advantages of ordered dither as a universal algorithm are presented. The design considerations, operation, and results of a low cost, ordered dither interface to realize 65 levels of intensity with a CCTV vidicon camera on a 16 bit parallel panel are given. A review of simple data compression methods that provide a 50 to 80% reduction in storage requirements is presented and the possible

implementation of a character plotting code on PLATO-type systems is discussed. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N75-33853 Rochester Univ., N.Y.
SUPERCONDUCTIVITY OF VANADIUM-BASED ALLOYS Ph.D. Thesis
Louis Anthony Pendrys 1975 126 p
Avail: Univ. Microfilms Order No. 75-22770

Superconductivity of binary alloys spanning the stoichiometric compounds V3Si, V3Ge, V3Ga, and V3AL was surveyed by studying samples prepared by RF co-sputtering from alloy cathodes. Surveys were also made of pseudo-binary alloys between the above compounds. Nearly bulk values of the superconducting transition temperature, Tc, were obtained for V3Si, V3Ga, and V3Ge. X-ray diffraction studies showed that the A-15 phase of V3Al was formed. A maximum Tc of 11.7 K was obtained for this compound. X-ray studies also showed that Vergard's law applies to these pseudo-binary systems and that new V3Al-rich pseudo-binary alloys were formed with V3Si, V3Ga, and V3Ge. Trends of Tc in the pseudo-binary systems indicate that the Tc of pure single-phase A-15 V3Al probably does not exceed 12 K. Dissert. Abstr.

N75-33854 Princeton Univ., N.J.
INFRARED PROPERTIES OF METALS AND WAVEVECTOR DEPENDENT LOCAL FIELD EFFECTS Ph.D. Thesis
Sidney Robert Nagel 1974 127 p
Avail: Univ. Microfilms Order No. 75-23228

A two-carrier model is used to explain the frequency dependence of the Drude relaxation time that was observed in recent experiments on metal films. One carrier is the electrons that exist in the crystallites, regions of high order; the other is the electrons in the grain boundaries, regions of low order. This model gives the same dependence on the annealing of the samples as was seen in gold as well as the same temperature dependence as was seen in indium. The design and construction of an infrared ellipsometer is described. The wavevector dependent local field corrections to the dielectric response of a solid are discussed. These effects are explicitly calculated in the point dipole approximation. A generalization to arbitrary wavevector of the classical Claussius-Mossoti equation is given and the relationship of this new equation to lattice dynamical calculations is discussed. Dissert. Abstr.

N75-33855 Rochester Univ., N.Y.
DETECTION OF HIGH FREQUENCY MICROWAVE PHONONS BY SUPERCONDUCTING TUNNEL AND JOSEPHSON JUNCTIONS Ph.D. Thesis
Timothy John Tredwell 1975 311 p
Avail: Univ. Microfilms Order No. 75-22783

The interaction of high frequency microwave phonons with superconductors is studied. Josephson junctions in the form of thin film microbridges and thin film point contact junctions are irradiated with 10 GHz microwave phonons. Aluminum tunnel junctions are irradiated with gap frequency microwave phonons. Within experimental error, the temperature dependence of the attenuation of both transverse and longitudinal phonons is found to follow the B.C.S. coherence factor for potential interactions. It is concluded that the coherence factor for the attenuation of transverse phonons is the same as that for longitudinal. This is in contrast to the effect observed at lower frequencies and confirms predictions that the electromagnetic coupling between transverse sound waves and electrons becomes unimportant at high phonon frequencies. Dissert. Abstr.

N75-33856 Polytechnic Inst. of New York.
ON FERROMAGNETIC RESONANCE IN HIGHLY ANISOTROPIC SINGLE CRYSTALS Ph.D. Thesis
Chen Hwa 1975 109 p
Avail: Univ. Microfilms Order No. 75-21369

Ferromagnetic resonance in insulating single crystals with anisotropic g factors was studied. The anisotropy of g factor allowed by the symmetry of the crystal has been considered and a classical phenomenological approach, guided by the well known Smit-Suhl method, has been taken to derive the resonance conditions. It has been concluded that a real characteristic frequency for resonance does not exist in a system with anisotropic g factor and isotropic saturation magnetization vector M. Dissert. Abstr.

N75-33857 Stanford Univ., Calif.
THE USE OF SUPERCONDUCTING SHIELDS FOR GENERATING ULTRA-LOW MAGNETIC FIELD REGIONS AND SEVERAL RELATED EXPERIMENTS Ph.D. Thesis
Blas Cabrera 1975 212 p
Avail: Univ. Microfilms Order No. 75-21850

Lead foil (0.0025 in. thick and 99.9% pure) is used to construct cylindrical superconducting magnetic shields with bottom end caps (4 in. dia. x 33 in. long and 8 in. dia. x 56 in. long). Several shields with absolute fields below 10 to the -8th power gauss over 20 in. along their axes were obtained. The shields are pleated, folded flat and then cooled through their transition (7 K) by heat flushing, i.e., moving the transition temperature from bottom to top in a slow and controlled manner. Cooling a shield inside of an outer previously heat flushed one produced the lowest fields when repeated 2 to 4 times. The magnetic fields are measured using a Josephson double point contact magnetometer with a differential sensitivity of 10 to the -9th power gauss coupled to a flip coil for absolute calibration. Residual trapped flux in small superconducting shields and remanent magnetization in materials used in ultra-low field regions were also studied. Dissert. Abstr.

N75-33858 Rochester Univ., N.Y.
THE DESIGN OF ELECTROOPTIC FREQUENCY SHIFTERS Ph.D. Thesis
Jean Louis Meyzonnette 1974 159 p
Avail: Univ. Microfilms Order No. 75-22758

After recalling the basic properties of electrooptic crystals, from the known design of a two-crystal, sinusoidally excited modulator, the possibilities of improvements by the use of more than two crystals were examined. Although the theoretical conversion efficiency and spectral purity are improved by the addition of more crystals, it is shown that, in practice, the two crystal modulator competes favorably with other designs. This particular set-up is studied, in the two configurations in which it may be used. By means of the Jones calculus, the reduction in performance caused by errors in various system parameters was determined. View field of the modulator is evaluated, as well as the decrease in performance when the crystals are not antireflection coated. The experimental study of two-crystal frequency shifters shows that the system operates very near its theoretical limits in both configurations. Dissert. Abstr.

N75-33859 New York Univ., N.Y.
POSITIONS IN METAL VACANCIES Ph.D. Thesis
James Harvey Fahs 1975 257 p
Avail: Univ. Microfilms Order No. 75-22879

A statistical model of the electron distribution around a vacancy in metals, based on the Thomas-Fermi approximation, was presented. Vacancy formation energies and residual resistivities are computed for a number of metals. The wave function of the positron and the new electron distribution are calculated self-consistently. The presence of a positron at the vacancy causes a redistribution of the electrons and a reduction of the vacancy screening of one electronic charge. The binding energy of a trapped positron is found to be of the order of 5 eV, supporting the usual assumption that positrons trapped in vacancies cannot escape. The reduction of the annihilation rates for trapped positrons, relative to those of positrons moving freely in the bulk, and the concomitant narrowing of the angular correlations are calculated and compared with experimental results. The effect of core annihilation on the model and the trapping mechanism are discussed. Dissert. Abstr.

N75-33860 Illinois Univ., Chicago.
PHONON INDUCED TRANSITIONS IN MOLECULAR CRYSTALS Ph.D. Thesis

Alan Isaac Attia 1975 139 p
Avail: Univ. Microfilms Order No. 75-23348

The interactions are studied which occur between coherent or randomly phased phonons, and molecules optically pumped to the first excited triplet state in a molecular crystal lattice. Firstly, randomly phased phonon induced transitions were investigated using thin film resistive heaters for the generation of heat pulses consisting of a superposition of elastic wave frequencies centered predominantly about the frequency kT/h. Secondly, coherent phonon induced transitions were investigated using recently developed ZnO piezoelectric transducers for the generation of longitudinally polarized hypersonic waves. The optically detected acoustic paramagnetic resonance of the metastable truplet state of 1,2,4,5-tetrachlorobenzene in zero field as well as an acoustic resonance signal induced by an off resonance acoustic field are reported. Dissert. Abstr.

N75-33861*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A PROCESS FOR FORMING A CRYSTALLINE FILM Patent Application.
Hans F. Wuenscher, inventor (to NASA) Filed 19 Sep. 1975 15 p
(NASA-Case-MFS-23226-1; US-Patent-Appl-SN-614990) Avail: NTIS HC $3.25 CSCL 20L

A process for forming crystalline films in a weightless environment is reported. The surface of a liquid melt is expanded by injecting a quantity of gas and then subsequently cooled in steps until crystallization to a predetermined configuration is obtained. Cooling takes place at a rate proportional to the rate of film expansion. NASA

N75-33862*# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
THEORETICAL INVESTIGATIONS OF PLASMA PROCESSES IN THE ION BOMBARDMENT THRUSTER Annual Contractor Report, 1 Jul. 1974 - 1 Sep. 1975
H. E. Wilhelm Oct. 1975 107 p refs
(Grant NGR-06-002-147)
(NASA-CR-134871) Avail: NTIS HC $5.25 CSCL 20I

A physical model for a thruster discharge was developed, consisting of a spatially diverging plasma sustained electrically between a small ring cathode and a larger ring anode in a cylindrical chamber with an axial magnetic field. The associated boundary-value problem for the coupled partial differential equations with mixed boundary conditions, which describe the electric potential and the plasma velocity fields, was solved in closed form. By means of quantum-mechanical perturbation theory, a formula for the number S(E) of atoms sputtered on the average by an ion of energy E was derived from first principles. The boundary-value problem describing the diffusion of the sputtered atoms through the surrounding rarefied electron-ion plasma to the system surfaces of ion propulsion systems was formulated and treated analytically. It is shown that outer boundary-value problems of this type lead to a complex integral equation, which requires numerical resolution. Author

N75-33863# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
PHENOMENOLOGICAL APPROACH TO HIGH TRANSITION SUPERCONDUCTING ALLOYS
S. J. Poon and W. L. Johnson Apr. 1975 37 p refs
(Contract AT(04-3)-822)
(CALT-822-72; Rept-63) Avail: NTIS HC $5.00

Correlations between the observed maximum superconducting transition temperature T sub c for a given binary alloys system and the alloy melting temperature T sub m are pointed out. The stability of alloy phases favorable for high temperature superconductivity is discussed in terms of alloy phase diagrams. A comparison with the microscopic theory shows that the correlation between T sub c and T sub m can be interpreted in terms of the d-electron contribution to the cohesive energy of transition metal alloys. The prospects for obtaining high T sub c's are discussed in view of these results, and new alloy systems are suggested. Author (NSA)

N75-33864# California Inst. of Tech., Pasadena. Div. of Engineering.
STUDIES OF ALLOY STRUCTURES AND PROPERTIES Annual Summary Report, 1 Dec. 1973 - 1 Dec. 1974
P. Duwez 1974 20 p refs
(Contract AT(04-3)-822)
(CALT-822-67) Avail: NTIS HC $4.00

Activities in research programs are reported on superconductivity in metal semiconductor alloys, Ag-Pb alloys, metastable cubic alloys, Cu-rich V3Si and V3Ga composites, liquid quenched alloys, and transition metal alloys. Results of research are also included on Moessbauer effects in iron phosphides, properties of Pb-Cu-P systems, and amorphous alloys. NSA

N75-33865# Oak Ridge National Lab., Tenn.
MATANO: A COMPUTER CODE FOR THE ANALYSIS OF INTERDIFFUSION AND INTRINSIC DIFFUSION IN FORMATION IN BINARY SYSTEMS
P. T. Carlson Jun. 1975 196 p refs
(Contract W-7405-eng-26)
(ORNL-5045) Avail: NTIS HC $7.60

MATANO is a FORTRAN 4 computer program written for use on the IBM 360/75 and 360/91 systems that determines interdiffusion and intrinsic diffusion coefficients from the experimental concentration penetration profiles of infinite and semi-infinite diffusion couples. The flexibility of the code enables the user to deduce experimental values of diffusion coefficients as well as to calculate expected values for any given system. The fundamental input array consists of the experimentally determined X-ray intensity penetration data obtained from electron microprobe analysis of the diffused couples, which the program subsequently converts to concentration penetration profiles by comparison with standards of known composition.
Author (NSA)

N75-33866# Brown Univ., Providence, R.I. Dept. of Chemistry.
CALCULATION OF IONIC CONDUCTIVITY ACTIVATION ENERGIES IN IONIC OXIDE GLASSES FROM SPECTROSCOPIC DATA
Gregory J. Exarhos, Philip J. Miller, and William M. Risen, Jr. 20 Feb. 1975 19 p refs
(Contract N00014-67-A-0191-0024; NR Proj. 051-539)
(AD-A007355; TR-75-01) Avail: NTIS CSCL 20/12

Activation energies for ionic conduction in inorganic oxide glasses are related to cation-motion vibrational band frequencies obtained from the far-infrared spectra of the glasses. The pseudo free ion approach is considered and a closely related formalism developed using vibrational energetics for the ion and its site, is employed. It leads to good correspondence between calculated and observed quantities and to the origin of the relationship of the ion motion distance to the critical vibrational amplitude. Comparisons of the calculated and observed quantities are presented for M2O-P2O5 glasses, M = Li(+), Na(+), Rb(+), Ag(+), and for a number of vitreous M2O x (xSiO2) systems.
GRA

N75-33867# RCA Labs., Princeton, N.J.
RADIATION AND CHARGE INJECTION IN Al2O3 USING NEW TECHNIQUES Interim Report, 17 Jun. - 16 Dec. 1974
Richard J. Powell 16 Jan. 1975 50 p refs
(Contract F19628-74-C-0132; DNA Proj. NWED-QAXTD033)
(AD-A010440; PRRL-75-CR-7; AFCRL-TR-75-0094) Avail: NTIS CSCL 20/12

Vacuum ultraviolet (VUV) radiation studies of pyrolytic Al2O3 films have shown the threshold for electron-hole pair production to be approximately 7.8 eV. The voltage dependence of radiation-induced charging shows a sharp maximum with gate voltage applied during irradiation. This is interpreted as competition between electron-hole pair generation and high-field electron injection from the electrodes. Charge centroid measurements using constant-current photoinjection have shown that the initially injected charge is trapped very near the Si-Al2O3 interface. High-field electron injection experiments using a constant-current technique have shown that the injection threshold is markedly improved with 70 A or more of SiO2 between the Si and Al2O3, but this improvement is obtained at the expense of reduced radiation hardness. GRA

N75-33868# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
GROWTH OF II-VI COMPOUND SEMICONDUCTOR CRYSTALS WITH REPRODUCIBLE AND STABLE DEFECT STRUCTURE Final Report, 1 Jul. 1964 - 30 Jun. 1974
Lawrence C. Greene Mar. 1975 19 p refs
(AF Proj. 7885)
(AD-A010526; ARL-75-0094) Avail: NTIS CSCL 20/12

In the cadmium sulfide crystals an easily observed and measured phenomenon is the low temperature bound exciton emission spectrum. The purpose of this work was to establish a relationship between the bound exciton spectra and the defect or impurity structure of the crystal. A line associated with a neutral donor and a pair of lines associated with an ionized donor were found for the very purest material. Lithium doped crystals showed several pairs of ionized donor lines as well as many characteristic neutral donor lines. Silver doping produced a large number of characteristic lines, but the nature of the associated centers has not been established. Sodium, potassium and rubidium doped crystals each showed characteristic neutral donor lines as well as many lines which could not be studied. GRA

N75-33869# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
DOSE DISTRIBUTIONS AT AND NEAR THE INTERFACE OF DIFFERENT MATERIALS EXPOSED TO COBALT-60 GAMMA RADIATION Physical Sciences Research Papers
J. A. Wall and E. A. Burke 17 Dec. 1974 32 p refs
(DNA Proj. QAXT-A040)
(AD-A010427; AFCRL-TR-75-0004; AFCRL-PSRP-620) Avail: NTIS CSCL 20/12

Determination of the radiation dose delivered to electronic devices and components exposed to radiation environments is basic to the assessment of system's vulnerability and hardening. In the region of the interface between materials of different composition, the radiation dose can be more than ten times that obtained by applying standard experimental or computational dosimetry methods. The present report describes experimental measurements of absorbed dose as a function of distance from the interface for a number of material combinations exposed to cobalt-60 gamma radiation. GRA

N75-33870# Rhode Island Univ., Kingston. Dept. of Electrical Engineering.
TEMPERATURE DEPENDENCE OF MULTIPHONON ABSORPTION IN FLUORITE CRYSTALS
S. S. Mitra, Herbert G. Lipson, and Bernard Bendow 15 May 1975 15 p refs Presented at Proc. of Conf. on Opt. Properties of Highly Transparent Solids, 1975
(Contract F19628-72-C-0286; AF Proj. 3326)
(AD-A010466; AFCRL-TR-75-0281) Avail: NTIS CSCL 20/12

The authors report measurements of the absorption coefficients of CaF2, SrF2 and BaF2 in the frequency range approximately 700 to approximately 1600 per cm, at temperatures ranging from 300 to 800 K. The frequency dependence is found to be nearly exponential-like in the temperature range investigated, in agreement with existing multiphonon theories. A detailed analysis of the measured temperature dependence, using the theories of Bendow, and of Namjoshi and Mitra, shows that the observed behavior conforms overall to that predicted for intrinsic multiphonon processes. The role of the temperature dependence of the phonon spectrum in suppressing the temperature dependence of the multiphonon absorption is also investigated. GRA

N75-33871# Parke Mathematical Labs., Inc., Carlisle, Mass.
CUMULANT METHODS IN THE THEORY OF MULTIPHONON ABSORPTION
Stanford P. Yukon and Bernard Bendow 15 May 1975 12 p refs Presented at Proc. of Conf. on Opt. Properties of Highly Transparent Solids, 1975 Prepared in cooperation with Brandeis Univ. Submitted for publication
(Contract F19628-71-C-0142)
(AD-A010465; AFCRL-TR-75-0278) Avail: NTIS CSCL 20/12

Recent studies suggest that multiphonon absorption in covalent solids is substantially influenced by contributions due to nonlinear electric moments. The authors demonstrate that the dielectric response in the latter case may be formulated in terms of a cumulant series involving lattice displacement correlators, which avoids the usual perturbative expansions of the moment and anharmonic potential in powers of displacements, and thus accounts for various classes of phonon processes to infinite order. To assess the utility of the method the authors compare results obtained by truncating the cumulant series with exact ones, calculated for a single-particle model. For parameters characteristic of typical binary semiconductors, the harmonic approximation to the cumulant yields poor results. On the other hand, the use of anharmonic correlators is shown to provide good agreement with exact behavior after several terms in the cumulant have been included. Overall, the results suggest that cumulant methods are highly promising for calculating multiphonon absorption coefficients. GRA

N75-33872# Brown Univ., Providence, R.I. Dept. of Physics.
THEORY OF MULTIPHONON ABSORPTION IN SEMICONDUCTING CRYSTALS Scientific Interim Report
See-Chen Ying, Bernard Bendow, and Stanford P. Yukon 14 May 1975 7 p refs Sponsored in part by NSF Prepared in cooperation with Parke Mathematical Labs., Inc.
(Contract F19628-71-C-0142)
(AD-A010460; AFCRL-TR-75-0272) Avail: NTIS CSCL 20/12

A correlation function approach is employed to calculate the multiphonon absorption in semiconducting crystals due to higher order electric moments, in the presence of anharmonicity. The authors found an exponential-like behavior for omega/omega sub O much greater than 1, with broader absorption for increasing anharmonicity. Results of numerical computations within a simplified single-particle model are presented for representative crystals. GRA

N75-33873# Parke Mathematical Labs., Inc., Carlisle, Mass.
THEORY OF MULTIPHONON ABSORPTION IN THE TRANSPARENT REGIME OF AMORPHOUS SOLIDS
Stanford P. Yukon, Yet-Pul Tsay, and Bernard Bendow 1974 11 p refs Prepared in cooperation with Brandeis Univ.
(Contract F19628-71-C-0142)
(AD-A010464; AFCRL-TR-75-0277) Avail: NTIS CSCL 20/12

The authors predict the multiphonon absorption alpha in amorphous solids, using the statistical theory of Mitra et al, which relates optical properties of amorphous solids to variations in their local density. As an application of the method, they perform calculations are performed for III-V semiconductors using an exactly soluble single-particle model which accounts for both anharmonicity and nonlinear moments. Broadening of alpha and suppression of the temperature dependence is predicted to occur to varying extents for the III-V's investigated. This suggests that various amorphous solids may not be as attractive as their crystalline counterparts for infrared applications requiring high transparency. GRA

N75-33874# New York Univ., N.Y.
THEORY OF INFRARED ABSORPTION Final Report, 1 Jul. 1972 - 31 Jun. 1974
J. L. Birman, Y. C. Cho, and C. S. Ting 31 Jun. 1974 11 p refs
(Contract F19628-73-C-0010; AF Proj. 5621)
(AD-A010455; AFCRL-TR-74-0442) Avail: NTIS CSCL 20/12

A theory is presented for multiphonon infra-red absorption including impurity effects. The theory can be used to calculate line shapes of impurity induced absorption. Other topics described include some group theory restrictions and systematics of multiphonon absorption. GRA

N75-33875# Stanford Univ., Calif.
EXPERIMENTAL STUDIES OF THE MICROWAVE PROPERTIES OF 8.6 GHz SUPERCONDUCTING NIOBIUM, NIOBIUM-TANTALUM, AND TANTALUM CAVITIES Ph.D. Thesis
Claude M. Lyneis Sep. 1974 141 p refs Sponsored by Office of Naval Res.

(AD-A001106; HEPL-737) Avail: NTIS CSCL 20/12

In this dissertation measurements on the surface impedance of superconducting niobium, tantalum, and a 30 at% niobium-70 at% tantalum alloy are reported. The measurements were made on X-band mode cavities at a nominal frequency of 8.6 GHz. The surface resistance and the change of surface reactance for the three materials were measured from 1.3 K up to their respective transition temperatures. These data were compared to computer calculations based on the Mattis-Bardeen expressions for the surface resistance and reactance of superconductors. Evidence is also presented concerning the effect of thermal expansion of niobium on the resonant frequency of an X-band cavity as a function of temperature below 2K. The influence of trapped magnetic flux on the microwave surface resistance and reactance of niobium is also reported. GRA

N75-33876# California Univ., La Jolla. Dept. of Physics.
VAN DER WAALS FORCES IN THE NOBLE METALS
J. J. Rehr, E. Zaremba, and Walter Kohn May 1975 22 p refs Sponsored in part by NSF
(Contract N00014-69-A-0200-6026; NR Proj. 017-653)
(AD-A010190; TR-31) Avail: NTIS CSCL 20/12

The van der Waals (or polarization) force between ions in the noble metals is calculated within a simplified model in which the ions are regarded as non-overlapping and immersed in a uniform electron gas. The conduction electron screening of the ion-ion interactions is straightforwardly taken into account. Using effective ionic polarizabilities derived from the measured optical constants, it is found that the contribution of the polarization forces to the cohesive energy per atom is 0.21 eV, 0.42 eV and 0.63 eV for Cu, Ag and Au, respectively. By comparison, the total cohesive energies in these metals are 3.50 eV, 2.96 eV and 3.78 eV, respectively. GRA

N75-33877# Clarkson Coll. of Technology, Potsdam, N.Y.
CTRUMP: ITS DEVELOPMENT AND USE IN SOLUTION OF PROBLEMS OF CONDUCTION HEAT FLOW IN SOLID STATE DEVICES
Robert L. Bastile and Henry Domingos Mar. 1975 156 p refs
(Contract F30602-72-C-0463)
(AD-A010002; RADC-TR-75-74) Avail: NTIS CSCL 09/1

The TRUMP program, developed by Arthur Edwards of the Lawrence Radiation Laboratory, has been adapted for use on the IBM 360/44, under the name CTRUMP. Modifications were made to enable calculations of three-dimensional heat flow in solid state devices, as a result of internal conduction and internal heat generation with constant boundary conditions. CTRUMP was then used to calculate temperature rise in thin film and carbon resistor models, as well as in a model of a gallium arsenide Gunn effect diode. An operating manual for CTRUMP is included as an Appendix. GRA

N75-33878# Cambridge Univ. (England). Dept. of Metallurgy and Materials Science.
STRUCTURAL STUDIES OF SURFACE DEFORMATION IN MgO, SiC AND Si3N4 Annual Technical Report, 1 Oct. 1973 - 30 Sep. 1974
O. O. Adewoye, G. R. Sawyer, J. W. Edington, and T. F. Page Oct. 1974 82 p refs
(Contract DAJA37-74-C-1310)
(AD-A008993) Avail: NTIS CSCL 20/12

A program of research has been initiated to study the detailed mechanical behaviour of silicon nitride and silicon carbide materials when subjected to surface loading in air at ambient temperatures. The overall objective is to develop a quantitative understanding of the parameters controlling microhardness, friction and wear behaviour. The effect of crystallographic orientation and load on the Knoop microhardness of silicon carbide single crystals and hot-pressed silicon nitride and silicon carbide has been investigated. Although no significant correlation of microhardness with general microstructure (or alpha/beta ratio in Si3N4) has yet been established, an empirical equation was fitted for each material which allowed confirmed identification of unknown material samples. Attempts to reveal slip behaviour by dislocation etch-pitting techniques on one of the polar (0001) surfaces have proved successful for undeformed crystals of low dislocation density. Microstructural and crystallographic techniques are currently being developed to allow transmission electron microscopy investigations to be made of the deformation substructure at carefully controlled depths beneath the tested surfaces. GRA

N75-33879# Northrop Research and Technology Center, Hawthorne, Calif.
RADIATION EFFECTS ON OXIDES, SEMICONDUCTORS, AND DEVICES Final Report, Mar. 1974 - Jan. 1975
Joseph R. Srour, Orlie L. Curtis, Jr., and Siegfried C. Othmer May 1975 207 p refs
(Contract DAAG39-73-C-0171; DNA Proj. NWED-QAXT; HDL Proj. 335400)
(AD-A010781; NRTC-75-5R; HDL-CR-75-171-1) Avail: NTIS CSCL 20/12

Contents: Oxide studies--Hole and electron transport in SiO2 films, Charge transport studies in SiO2: processing effects and implications for radiation hardening, Ionizing dose rate effects in MOS devices, Experiments on MOS capacitors fabricated on a p-type silicon substrate, Ion microanalyzer measurements on SiO2 films, Effects of bias polarity on current flow in SiO2 under electron beam injection, Studies of charge transport and charge buildup in pure SiO2 and Al--implanted pure SiO2, Determination of hole mobility in SiO2 films; Semiconductor studies. GRA

N75-33880# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
HARDENED HYBRID SEMICONDUCTOR PACKAGES, TASK 2 Final Report, 1-31 Jan. 1975
Frank A. Lindberg May 1975 24 p
(Contract DAAG39-73-C-0216; HLD Proj. 373433)
(AD-A010782; Rept-75-0516; HDL-CR-75-216-1) Avail: NTIS CSCL 09/1

The work was performed to develop a radiation hardened packaging technique for packaging a whole round semiconductor wafer. The metal which connected the wafer bonding pads to the package output pins was aluminum which was vapor deposited through a mask on the inside surface of the package. One end of each conductor line was lifted off the package surface to form a beam lead. These beam leads were then ultrasonically bonded to the wafer bonding pads. GRA

N75-33881# Utah Univ., Salt Lake City.
ANGULAR DEPENDENT RAMAN SCATTERING STUDIES OF KH2PO4
C. H. Wang, R. W. Grow, and M. K. Srivastava 15 May 1975 20 p refs
(Contract N00014-75-C-0908; NR Proj. 051-562)
(AD-A010884; TR-9) Avail: NTIS CSCL 20/12

Raman scattering spectra of a KH2PO4 single crystal were measured at various crystal orientations relative to the incident and scattered light propogation directions. It has been found that the contribution of the long-range electrostatic interaction is less than 10% of the total scattering efficiency of the E(x) and B2(z) modes in KDP. A low frequency mode, previously predicted by group theory, was also observed for the first time. GRA

N75-33882# Northwestern Univ., Evanston, Ill. Dept. of Materials and Engineering.
CAPACITANCE STUDIES ON SYNTHETIC PHOSPHOLIPID LANGMUIR FILMS
W. L. Procarione and J. W. Kauffman May 1975 30 p Submitted for publication
(Contract N00014-67-A-0356-0031)
(AD-A010889; TR-1) Avail: NTIS CSCL 20/12

Synthetic phosphatidylcholine Langmuir films have been incorporated into metal-insulator-metal (MIM) thin film junctions. The capacitance characteristics of these junctions have been studied as a function of temperature, the number of lipid layers in the insulating layer, and the length of the hydrocarbon chains of the lipid molecule. The thickness of the oxide layer on the base aluminum electrode has been determined to be approximately 40A, and its effects on the capacitance characteristics has been considered in some detail. Indications of phase transitions in the temperature dependence of the capacitance imply that the basic lamellar arrangement of the lipid molecules is retained even after the samples are subjected to a dehydrating vacuum annealing process. An examination of the effects of varying the

hydrocarbon chain length and salt content of the subphase during sample fabrication showed that capacitance characteristics of the MIM junction are very sensitive to small structural changes in the insulating layer. GRA

N75-33883# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
STANDARD REFERENCE MATERIALS: THERMAL CONDUCTIVITY AND ELECTRICAL RESISTIVITY STANDARD REFERENCE MATERIALS, ELECTROLYTIC IRON, SRM'S 734 AND 797 FROM 4 TO 1000 K
J. G. Hust and P. J. Giarratano Jun. 1975 46 p refs
(COM-75-10698/9; NBS-SP-260-50; LC-74-619117) Avail: NTIS HC $3.75; HC also available from SOD as C13.10:260-50 CSCL 20L

A historical review of the development of Standard Reference Materials, SRM's, is given and selection criteria of SRM's are listed. Thermal conductivity and electrical resistivity data for electrolytic iron and similar irons are compiled, analyzed, and correlated. Recommended values of thermal conductivity and electrical resistivity for electrolytic iron are presented for the range 4 to 1000 K. These values are based on NBS measurements up to 280 K and on measurements by Oak Ridge National Laboratory on a similar iron above 280 K. The average uncertainty of the thermal conductivity values below ambient is 1.5% and 3% above ambient. The corresponding uncertainties in electrical resistivity are 1% and 2%. GRA

N75-33884# Naval Surface Weapons Center, White Oak, Md.
THE EFFECT OF EXCHANGE ON THE THEORY OF THE ORDER-DISORDER AND THE INSULATOR-METAL TRANSITIONS IN MAGNETITE, Fe3O4 Final Report
Tomoyasu Tanaka, Charles Chen, and Louis F. Libelo 1 Apr. 1975 36 p refs
(ZR0110101)
(AD-A010544; NSWC/WOL/TR-75-41) Avail: NTIS CSCL 20/12

Using a Hartree-Fock decoupled Hamiltonian, electronic energy bands for magnetite, Fe3O4 have been determined at temperatures in the neighborhood of the Verwey transition temperature. The cluster-variation method has been applied to determine the parameters appearing in the Hartree-Fock Hamiltonian. It was observed that the insulator-metal transition takes place at a temperature where the Verwey order is still finite although it is quite small. As long as the Verwey transition persists as a second order transition the theory here predicts two different distinct transition temperatures, one for the insulator-metal transition and the other for the order-disorder transition. GRA

N75-33885# Illinois Univ., Urbana. Coordinated Science Lab.
ACOUSTIC GENERATION BY NONUNIFORM POLARIZATION IN FERROELECTRIC CERAMICS
Robert Joseph Kansy, Jr. May 1975 148 p refs
(Contract DAAB07-72-C-0259)
(AD-A010728; R-681; UILU-ENG-75-2216) Avail: NTIS CSCL 20/12

The thesis is a study of acoustic generation by the interaction of a uniform a-c electric field and a nonuniform polarization in a ferroelectric ceramic plate. The nonuniform polarization is induced by the temporary application of a strong d-c electric field to an interdigital transducer deposited on the surface of an unpolarized ferroelectric ceramic plate. The effect of the polarization is described in terms of a spatially variant tensor containing the effective local values of the piezoelectric constants. This previously unpublished concept is applied to modified equations of motion for the isotropic elastic plate. Expressions are obtained for the resonant mode frequencies, excitation bandwidths and relative power levels. Experimental data are taken in the form of input impedance and delay line insertion loss versus frequency. Theoretical and experimental data are compared and found to be in good qualitative agreement. GRA

N75-33886# Bowmar Canada, Ltd., Ottawa (Ontario). Optoelectronics Div.
ROOM TEMPERATURE INJECTION LUMINESCENCE IN 2-6 SEMICONDUCTORS Final Report, Dec. 1971 - May 1974
Norman M. P. Lowland and L. H. W. Bradfield Wright-Patterson AFB, Ohio AFML Feb. 1975 212 p refs
(Contract F33615-72-C-1466; AF Proj. 7367)
(AD-A010659; AFML-TR-74-274) Avail: NTIS CSCL 20/6

In a continuation of previous investigations of injection luminescent device structures several theoretical models are discussed which may account for the blue electroluminescence emission from nominally undoped or compensated ZnS diodes. An alternative objective for the investigations has involved experimental work on polycrystalline II-VI compounds and polycrystalline III-V compound materials, and the evaluation of the potential of these materials in light-emitting device applications. Other experimental studies included a comprehensive evaluation program on the morphological features of the ZnS and ZnSe powders, the microstructure of the hot-pressed II-VI and III-V compound powdered compact, the photoluminescence emission properties of the hot-pressed material before and after annealing treatment in various ZnAl alloys, and the structural analysis of polycrystalline solid solutions of II-VI and III-V compounds using X-ray diffraction techniques. Fabricated devices were evaluated in terms of their electrical and d.c. electroluminescence characteristics; the latter results were correlated with the basic photoluminescence properties of the materials. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N75-33887+ Engineering Sciences Data Unit, London (England).
HEAT CAPACITY AND ENTHALPY OF LIQUIDS. 1: AROMATIC HYDROCARBONS
Aug. 1975 18 p refs Sponsored by Inst. of Chem. Engr.
(ESDU-75015) Copyright. Avail: NTIS HC $146.50

Evaluated heat capacity and enthalpy data are provided for liquid aromatic hydrocarbons for application in the design of process plant such as distillation columns, heat exchangers, and reactors. The range of applicability includes C6 to C18 compounds with temperatures from the melting point to normal boiling point. The procedure used to obtain the heat capacity values is described along with the effects of pressure. Author

N75-33888*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
CHARACTERIZATION OF MEASUREMENTS IN QUANTUM COMMUNICATION Ph.D. Thesis
Vincent W. S. Chan 10 Sep. 1975 135 p refs
(Grant NGL-22-009-013)
(NASA-CR-119008; TR-489) Avail: NTIS HC $5.75 CSCL 20J

A characterization of quantum measurements by operator valued measures is presented. The generalized measurements include simultaneous approximate measurement of noncommuting observables. This characterization is suitable for solving problems in quantum communication. Two realizations of such measurements are discussed. The first is by adjoining an apparatus to the system under observation and performing a measurement corresponding to a self-adjoint operator in the tensor-product Hilbert space of the system and apparatus spaces. The second realization is by performing, on the system alone, sequential measurements that correspond to self-adjoint operators, basing the choice of each measurement on the outcomes of previous measurements. Simultaneous generalized measurements are found to be equivalent to a single finer grain generalized measurement, and hence it is sufficient to consider the set of single measurements. An alternative characterization of generalized measurement is proposed. It is shown to be equivalent to the characterization by operator-values measures, but it is potentially more suitable for the treatment of estimation problems. Finally, a study of the interaction between the information-carrying system and a measurement apparatus provides clues for the physical realizations of abstractly characterized quantum measurements. Author

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N75-33889# Illinois Univ., Urbana.
AN EXPERIMENTAL EVALUATION OF A COMPUTER-ASSISTED INSTRUCTION STUDY MANAGEMENT SYSTEM (CAISMS) Technical Report, 1 Jan. - 1 Nov. 1974
Thomas H. Anderson, Richard C. Anderson, Bruce R. Dalgaard, Donald W. Paden, and W. Barry Biddle Apr. 1974 16 p refs
(Contract N61339-73-C-0078)
(AD-A010119; NPRDC-TR-75-31) Avail: NTIS CSCL 05/9

A Computer-Assisted Instruction Study Management System (CAISMS) was experimentally investigated in the context of an introductory college economics course. The 228 students in the CAISMS and control classes attended similar lecture-discussion classes and received an identical battery of achievement tests and questionnaires during the semester. GRA

N75-33890# Florida State Univ., Tallahassee. Center for Educational Technology.
ANALYSIS AND ASSESSMENT OF THE STATE OF THE ART IN INSTRUCTIONAL TECHNOLOGY Final Report
Robert K. Branson, John H. Stone, Wallace H. Hannum, and Gail T. Rayner 5 Dec. 1973 75 p refs
(Contract N61339-73-C-0150)
(AD-A010394) Avail: NTIS CSCL 05/9

The application of the state of the art techniques in Instructional Technology at TRADOC schools and training centers was examined. This assessment revealed that systems engineering regulations and guidance, personnel, facilities, and materials available at TRADOC Schools and training centers make it feasible to increase competent applications of instructional technology. The study found a distinct emphasis on training new people in applications of instructional technology with significant changes occurring. Changes in the TRADOC schools and training centers have been principally noted in those persons actually performing the technical work. An articulated training program is required which provides each individual assigned to the school or training center. This program should contain training materials designed specifically for middle and senior managers. The increasing application of Instructional Technology at TRADOC Schools and centers was apparent. GRA

N75-33891# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SOPHIE: A SOPHISTICATED INSTRUCTIONAL ENVIRONMENT
John Seely Brown, Richard R. Burton, Alan G. Bell, and Robert J. Bobrow Dec. 1974 51 p refs
(Contract F41609-74-C-0015; AF Proj. 1121)
(AD-A010109; AFHRL-TR-74-93) Avail: NTIS CSCL 05/9

The SOPHIE program, which implements mixed initiative CAI within a simulated electronics troubleshooting training laboratory interaction, has been extended in several manners. The language processor now accepts ellipses and other nonspecific requests and resolves these from dialogue context. A help requesting facility has been provided which will suggest possible faults (based on the student's knowledge about the circuit at the time of request) which could explain the symptoms he has observed. The net effect of modifications is that a dialogue is much more like a conversation with a very skilled tutor who can infer what a student means, based on a complete interaction session, and respond appropriately. The resulting program can be accessed through the ARPA network of computers. GRA

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N75-33892# Joint Publications Research Service, Arlington, Va.
RESEARCH AND DEVELOPMENT PLANNING
3 Feb. 1975 23 p refs Transl. into ENGLISH from unidentified Russian report
(JPRS-64010) Avail: NTIS HC $3.25

Data are presented on organizing the development and implementation of large-scale interbranch scientific-technical programs, and the selection of preferential variants of a draft plan for a complex system. For individual titles, see N75-33893 through N75-33894.

N75-33893 Joint Publications Research Service, Arlington, Va.
ORGANIZING THE DEVELOPMENT AND IMPLEMENTATION OF LARGE-SCALE INTERBRANCH SCIENTIFIC TECHNICAL PROGRAMS
K. A. Yefimov *In its* Res. and Develop. Planning (JPRS-64010) 3 Feb. 1975 p 1-10 Transl. into ENGLISH from unidentified Russian report (For availability see N75-33892 24-81)

For the development of interbranch programs for the advancement of technology, it is considered necessary to forecast the basic trends in science and technology. Coordination plans, and the indices of economic effectiveness are discussed. F.O.S.

N75-33894 Joint Publications Research Service, Arlington, Va.
SELECTION OF PREFERENTIAL VARIANTS OF A DRAFT PLAN FOR A COMPLEX SYSTEM
O. I. Larichev, V. M. Ozernoy, and M. G. Gaft *In its* Res. and Develop. Planning (JPRS-64010) 3 Feb. 1975 p 11-19 refs Transl. into ENGLISH from unidentified Russian report (For availability see N75-33892 24-81)

The problems are discussed of increasing the effectiveness in the application of scientific inventions to the production stage. The selection of efficient variants for technological inventions for coal mines was considered. The methodology is described for resolving the variants for obtaining well-substantiated decisions for mining. F.O.S.

N75-33895*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE ACADEMY OF SCIENCES OF THE USSR, ANALYSIS AND COMPARISON WITH US ORGANIZATIONS
Roger M. Nicholson Aug. 1971 30 p refs
(NASA-TM-X-64629) Avail: NTIS HC $3.75 CSCL 05A

The organization, activities, and history of the U.S.S.R. Academy of Sciences and the overall science policy, structure, and the framework of the Soviet higher educational system are discussed. Additionally, the federal science policy structure of the United States is outlined; a comparison is made between the U.S.S.R. Academy of Sciences and the U.S. National Academy of Sciences. The U.S.S.R. Academy of Sciences is identified as a principal factor of policy direction in the total framework of the Soviet science policy structure. Author

N75-33896# Data Resources, Inc., Lexington, Mass.
FEDERALLY SUPPORTED MATHEMATICAL MODELS: SURVEY AND ANALYSIS. VOLUME 1: ANALYSIS AND CONCLUSIONS Final Report
Gary Fromm, William L. Hamilton, and Diane E. Hamilton Jun. 1974 87 p refs Prepared in cooperation with ABT Assoc., Inc., Cambridge, Mass. 3 Vol.
(Contract NSF C-804)
(PB-241562/8; NSF/RA/S-74-031-Vol-1) Avail: NTIS HC $4.75; HC available in a set of 3 reports as PB-241561-SET HC $18.00 CSCL 05A

Mathematical models can be employed in developing understanding of physical, economic, social and other phenomena, for forecasting, and in simulating the impacts of different structural and policy scenarios. The present study attempts to examine the extent to which and the ways in which federal agencies use models. The results of an extensive survey of Federal agencies are analyzed and conclusions are drawn. The report recommends that improvements must be made in the availability of data, in procedures used to fund and monitor research, and in information flows between model builders and policy makers. GRA

N75-33897# Data Resources, Inc., Lexington, Mass.
FEDERALLY SUPPORTED MATHEMATICAL MODELS SURVEY AND ANALYSIS. VOLUME 2: MODEL REFERENCES Final Report
Gary Fromm, William L. Hamilton, and Diane E. Hamilton Jun. 1975 150 p refs Prepared in cooperation with ABT Assoc.,

Inc., Cambridge, Mass. 3 Vol.
(Contract NSF-C-804)
(PB-241563/6; NSF/RA/S-74-029-Vol-2) Avail: NTIS HC $5.75; HC also available in a set of 3 reports as PB-239304-SET HC $18.00 CSCL 05A

The present study examines the ways in which Federal agencies use models described in Volume 1. Four listings are presented. The first lists the projects alphabetically by Project Director. The second lists the models according to the institution at which they were developed. The third listing is organized by sponsoring agency. The final listing is by subject area. GRA

N75-33898# Data Resources, Inc., Lexington, Mass.
FEDERALLY SUPPORTED MATHEMATICAL MODELS: VOLUME 3: TECHNICAL APPENDICES Final Report
Gary Fromm, William L. Hamilton, and Diane E. Hamilton Jun. 1974 369 p Prepared in cooperation with ABT Assoc., Inc., Cambridge, Mass. 3 Vol.
(Contract NSF-C-804)
(PB-241564/4; NSF/RA/S-74-030-Vol-3) Avail: NTIS HC $10.00; also available in a set of 3 reports as PB-241561-SET HC $18.00 CSCL 05A

The appendices to the study are presented: the project director questionnaire; the agency monitor questionnaire; and the tables compiled for the study. GRA

N75-33899# Connecticut Univ., Storrs. Inst. of Materials Science.
PROPOSAL FOR AN EXPERIMENT ON PROVIDING INCENTIVES FOR INDUSTRY-UNIVERSITY RESEARCH COLLABORATION Final Report
Leonid V. Azaroff Jun. 1974 85 p
(Grant NSF DI-39492)
(PB-242329/1; NSF/RA/R-74-001) Avail: NTIS HC $4.75 CSCL 05A

A potential experiment in cooperative research involving a university and an industry, is described whereby limited government cost-sharing is used as an incentive for establishing a long term cooperative program. The steps taken in attempting to establish the cooperative program with industrial organizations specifically inclined to exploit plastic materials are included. Barriers encountered, steps taken to overcome barriers, and conditions necessary to induce industrial participation in the program are outlined. GRA

N75-33900# Teknekron, Inc., Berkeley, Calif.
BACKGROUND STUDY OF ALTERNATIVE POLICIES WHICH WOULD PROMOTE UNIVERSITY FINANCED TECHNICAL INNOVATION Final Report
David Fain Dec. 1974 89 p refs
(Contract NSF C-819)
(PB-242178/2; NSF/RA/R-74-062) Avail: NTIS HC $4.75 CSCL 05A

The transfer of technology from the university laboratory in to the private sector of the economy through the formation of new companies the feasibility of conducting an experiment on insuring university endowment funds invested in such new ventures. A review was made of the published literature, and of unpublished reports, theses, and special studies on the formation of new technology-based companies and on entrepreneurship. The process of establishing new technology-based companies, the requirements for start-up capital, possible sources for such funds, and legislative incentives are discussed. GRA

N75-33901# Michigan Univ., Ann Arbor. Inst. for Social Research.
CHARACTERISTICS OF SUCCESSFUL AND UNSUCCESSFUL ORGANIZATIONAL DEVELOPMENT
Jerome L. Franklin Mar. 1975 75 p refs
(Contract N00014-67-A-0180-0013; NR Proj. 170-719)
(AD-A006912) Avail: NTIS CSCL 05/1

Several characteristics of organizations, their environments, and development efforts are evaluated to determine their association with successful and unsuccessful change in 25 organizations. Four groups of characteristics differentiating between successful and unsuccessful change efforts indicate: (1) commitment to and use of survey feedback and interpersonal process consultation interventions are associated most closely with success in OD efforts while an emphasis on sensitivity training/T-groups is most closely associated with the unsuccessful organizations; (2) organizations that are more stable and staid are less likely to be successful in their OD efforts than are those which are expanding and more open to and involved in adjusting to change; (3) internal resource persons who are less carefully selected, receive change-agent training previous to the OD effort, and do not possess assessment-prescriptive skills are found in the unsuccessful organizations; and (4) more specific interests and greater commitment to the OD efforts are associated with successful change. GRA

N75-33902# Army War Coll., Carlisle Barracks, Pa.
BETTER CONTROL IS NEEDED
Richard W. Cayll 28 Jan. 1975 19 p refs
(AD-A009948) Avail: NTIS CSCL 05/1

The basic question of 'What is control' is discussed as it applies in any management situation in general and as it may be applied in management in the Army today. Control is the essential element which ties the management functions together with a system. The relatively new decision sciences of systems analysis and cybernetics are discussed in relation as to how they may be applied by the Commander in his day-to-day decision-making. Feedback theory is shown to be an essential part of controlling. Performance indicators are too often used by the Commander alone to tell him what is wrong with a unit. A control system for any organization must be well planned and the Commander must take a systematic approach to management control if he expects to gain his objectives. GRA

N75-33903# Mentoris Co., Sacramento, Calif.
EXPERIMENTAL DEFINITION PHASE FOR MARKETING THE NASA AUTOMATED ATTENDANCE MANAGEMENT SYSTEM Final Report
Ewart E. Smith, W. J. Schimandle, and Elmer Dewey Hill Sep. 1974 43 p ref
(Grant NSF DI-42350)
(PB-242185/7; NSF/RA/R-74-048) Avail: NTIS HC $3.75 CSCL 05A

This report is part of a larger effort to explore how best to transfer technology which originated in Federal laboratories to the civilian/commercial sector. A transfer was conducted according to a semistructured work statement which emphasized the early establishment of formal linkages, the negotiations of commitments of substance, and the development of a technology transfer plan by all necessary participants for a successful transaction. The transfer of an automated attendance management system to public school districts in California is discussed. GRA

N75-33904# American Society of Civil Engineers, New York.
REPORTS ON THE DEVELOPMENT OF A PROGRAM PLAN FOR AN EXPERIMENTAL R/D INCENTIVES PROGRAM IN THE CONSTRUCTION INDUSTRY. PART 1: SUMMARY REPORT ON PROGRESS. PART 2: PROGRAM DESCRIPTION Final Report
Donald C. Taylor Jun. 1974 38 p refs
(Grant NSF DI-39521)
(PB-242227/7; NSF/RA/R-74-050-Pt-1;
NSF/RA/R-74-050-Pt-2) Avail: NTIS HC $3.75 CSCL 13M

Results are summarized of a study to determine barriers to and incentives for stimulating the support of research and innovation by the construction industry. Objectives developed for a Federal cost-sharing incentive experiment, and how the program would plan to continue after termination of NSF funding are discussed. Interim findings, conclusions, and recommendations were developed which concerned: organizational interest in the experiment; research and innovation within the construction industry; barrier indentification; and further funding plans, availability, and commitments. A project description of the potential subject areas and specific experiments proposed is included. GRA

N75-33905# Hawaii Univ., Honolulu. Dept. of Information and Computer Science.
OPTIMAL RESOURCE ALLOCATION AND SCHEDULING AMONG PARALLEL PROCESSES
Art Lew 1975 18 p refs

(Contract DAHC04-74-G-0110)
(AD-A011032; ARO-11944.3-EL) Avail: NTIS CSCL 12/2

The problem of optimally allocating limited resources among competing processes may be formulated as a problem in finding the shortest path in a directed graph, provided a quantitative measure of the performance of each process as a function of its resource allocation can be suitably defined. If this measure is also a function of time, scheduling problems arise so that optimal allocations become time-varying and may depend upon various precedence relations or constraints among the processes. Dynamic programming approaches to such allocation and scheduling problems are presented in the context of parallel processing. GRA

N75-33906# RAND Corp., Santa Monica, Calif.
INTERDISCIPLINARY POLICY RESEARCH IN INDEPENDENT RESEARCH CENTERS
Walter S. Baer Jan. 1975 19 p refs Presented at Ann. Meeting of Am. Assoc. for the Advancement of Sci., New York, 29 Jan. 1975 Sponsored in part by the John and Mary R. Markle Foundation
(AD-A010961; P-5347) Avail: NTIS CSCL 05/1

Interdisciplinary research is discussed with regard to policy research, not basic research in the physical or social sciences. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N75-33907# National Library of Medicine, Bethesda, Md.
TECHNICAL NOTES: MEDLARS INDEXING INSTRUCTIONS
Thelma Charen Apr. 1975 125 p refs
(PB-241734/3; NLM-MED-75-06-Suppl) Avail: NTIS HC $5.25 CSCL 05B

The indexing guide intended primarily for MEDLARS analysts and users is presented. It is expected that after MEDICAL SUBJECT HEADINGS and the MEDLARS INDEXING MANUAL, the TECHNICAL NOTES will be used by indexers and searchers as the authority on indexing practices. The purpose of the TECHNICAL NOTES is to discuss practices relating to groups of concepts, lying half-way between the generalities of the INDEXING MANUAL and the specificities of MeSH annotations. The source of subjects discussed in TECHNICAL NOTES is queries and problems posed by indexers and searchers. GRA

N75-33908# Operating Systems, Inc., Tarzana, Calif.
A COMPARATIVE EVALUATION OF STRUCTURED AND FREE TEXT SEARCHING OF THE NHTSA DATA BASE Final Report
Jan. 1975 77 p refs
(Contract DOT-HS-251-2-444)
(PB-241288/0; DOT-HS-801414) Avail: NTIS HC $4.75 CSCL 05B

A comparative evaluation of two computerized retrieval systems is given. The two systems operate on the same document collection, but one uses conventional thesaurus search terms for indexing and access to the collection in a batch mode, while the other is an interactive system that provides direct access to document abstracts to a set of user queries, and scoring the output according to a retrieval effectiveness measure. The results show that there is no significant difference between the retrieval effectiveness of the two systems. Secondary evaluation criteria dealing with human factors and systems aspect are also discussed. The analysis shows that the interactive system has considerable advantages over the batch mode system, especially in regard to user human factors. GRA

N75-33909# Naval Research Lab., Washington, D.C.
REPORT ON NRL PROGRESS
Feb. 1975 62 p refs
(PB-241538/8) Avail: NTIS HC $4.25 Also available from NTIS on subscription $40.00/year domestic, $50.00/year foreign CSCL 05B

Research projects in the area of oceanography, radar, and radiation effects are summarized. Topics discussed include microwave equipment, ceramic materials, piezoelectric materials, metallurgy, optical materials, air water interactions, radar reflection, ocean waves, and electromagnetic scattering. M.J.S.

N75-33910# National Environmental Research Center, Cincinnati, Ohio.
FORTRAN PROGRAMS FOR ANALYZING COLLABORATIVE TEST DATA. PART 1: GENERAL STATISTICS
Elmo C. Julian Apr. 1975 47 p refs
(PB-241707/9; EPA-670/4-75-004-A-Pt-1) Avail: NTIS HC $3.75 CSCL 09B

A FORTRAN program for IBM 1130 is described by which general statistics on inter-laboratory studies of chemical analytical methods may be obtained. Data screening followed by a statistical t-test for identifying outliers is included. A histogram of data in ascending order is provided. GRA

N75-33911# National Environmental Research Center, Cincinnati, Ohio.
FORTRAN PROGRAMS FOR ANALYZING COLLABORATIVE TEST DATA. PART 2: SCATTER DIAGRAMS
Elmo C. Julian Apr. 1975 38 p refs
(PB-241708/7; EPA-670/4-75-004-B-Pt-2) Avail: NTIS HC $3.75 CSCL 09B

A FORTRAN program for IBM designed to plot three pairs of data sets in three scatter diagrams on one page is described. These data stem from interlaboratory studies of chemical analytical methods. GRA

N75-33912# Mead Technology Labs., Dayton, Ohio.
AVIONICS CENTRAL DATA BASE MANAGEMENT SYSTEM Final Technical Report, 12 Feb. 1972 - 30 Jun. 1974
Paul H. Beck May 1975 16 p refs
(Contract F33615-72-C-1969; AF Proj. 2004)
(AD-A010419; AFAL-TR-75-88) Avail: NTIS CSCL 05/2

The major objectives of the planned program of work on this contract are the continuous operation, maintenance, modernization, and development of a high-speed, random access, computer controlled, Avionics Technical Information Handling System for Air Force engineers, managers, and staff planners. The elements of the services provided under the contract are a free turnkey operated computer system, terminals, and data communication, and data base administration personnel. GRA

N75-33913# Massachusetts Inst. of Tech., Cambridge. Div. of Sponsored Research.
LASER BIBLIOGRAPHIC SEARCH Final Report, 23 Jun. 1971 - 30 Jun. 1972
Myer M. Kessler 27 Jan. 1973 6 p refs
(Contract F19628-71-C-0249; AF Proj. 3326)
(AD-A010443; AFCRL-TR-74-0139) Avail: NTIS CSCL 05/2

An application of sophisticated computer search techniques of both AIP-Spin tapes covering literature of physics and the Chemical Abstracts tapes covering literature of chemistry was adopted to the specialized profiles of several people working in the areas of electro-magnetic materials. They serve to provide entire abstracts of selected papers in the areas of alkali halides, deformation, silicon carbide, and on occasion were to search on particular authors. The methodology established proves the validity of the concept when applied to people who want rapid access when searching current literature. GRA

N75-33914# Physics International Co., San Leandro, Calif.
FEASIBILITY OF ARCHIVING, AT AGBABIAN ASSOCIATES, THE GROUND MOTION DATA RESIDING AT PHYSICS INTERNATIONAL COMPANY Final Report, 11 Feb. - 31 Dec. 1974
T. Stubbs May 1975 20 p refs
(Contract DNA001-74-C-0205; DNA Proj. NWED-QAXS)
(AD-A010153; PIFR-684; DNA-3631F) Avail: NTIS CSCL 17/10

A system was developed to introduce digital information

into the archives maintained by Agbabian Associates. Cataloging and retrieval of data was tested using the ground motion records obtained from the MINE THROW I event. Both functions were found to be satisfactory. Data on file, which are amendable to archiving, are enumerated. Author (GRA)

N75-33915# Boeing Aerospace Co., Seattle, Wash.
O AND M EXPERIENCE INFORMATION COLLECTION FOR HYDROFOIL TEST AND LEAD SHIPS
W. L. Johnson and D. B. Larsen Apr. 1975 167 p
(Contract N00600-69-C-0618)
(AD-A010038; D321-13008) Avail: NTIS CSCL 13/10

The report addresses a study for the collection of operations and maintenance experience information on hydrofoil ships during the research and development and lead ship test and evaluation phases for new programs. The report identifies the technical community, their information requirements, and the data elements needed to satisfy those requirements. Required data elements are evaluated and compared with five other military data collection systems. A system, titled Operations and Maintenance (O and M) Experience Information Collection for Hydrofoil Test and Lead Ships, is developed to satisfy the above objective. Discussion includes what data is required, how it is collected, the forms used, and the processing procedures. GRA

N75-33916# Air Force Weapons Lab., Kirtland AFB, N.Mex.
KIRTLAND AIR FORCE BASE SCIENCE AND ENGINEERING SYMPOSIUM. VOLUME 2: UNCLASSIFIED SESSION Final Report, Jan. 1973 - Jan. 1974
Apr. 1975 181 p refs Symp. held at Albuquerque, N. Mex., 4 Jun. 1974
(AD-A010043; AFWL-TR-74-159-Vol-2) Avail: NTIS CSCL 05/2

Contents: Gyroscope dynamic modeling; kinetic cooling of the atmosphere via a high-power CO2 laser--the first direct experimental observation of a unique enhancement mechanism; the Air Force weapons laboratory system for evaluation of runway hydroplaning potential; worst case EMP calculations; more accurate airplane cost growth assessment; measurement of high-altitude optical turbulence; modification analysis and testing of a unique meteorological instrument; development and application of a low-cost gas dynamic laser test facility; epoxy canister development; completely integrated reference instrumentation system (CIRIS). GRA

N75-33917# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 29, NO. 5
Waldo G. Magnuson, Jr. and Victoria S. Hewitson 31 May 1975 55 p refs
(AD-A010524; ESN-29-5) Avail: NTIS CSCL 05/2

The monthly publication presents articles about recent developments in European Scientific Research. Although this information is not a contribution to the scientific literature, it is intended to aid American scientists by reporting events and results well in advance of most of the scientific publications and trade journals. GRA

N75-33918# Oklahoma State Univ., Stillwater. Center for Local Government Technology.
A RESEARCH PROJECT TO DEVELOP A DESIGN FOR A TECHNOLOGY NEEDS, ARTICULATION AND AGREGATION SYSTEM IN OKLAHOMA Final Report
Joseph H. Mize Apr. 1974 262 p refs
(Grant NSF DI-41031)
(PB-242162/6; NSF/RA/R-74-038) Avail: NTIS HC $8.50 CSCL 05B

The report describes a university-based program variation of the USDA Cooperative Extension Service model designed for the diffusion/dissemination of technology to small local governments in rural Oklahoma. Thirteen major technological needs of small rural governments were identified in such areas as manpower scheduling and equipment allocation, and 'solution packages' were developed in cooperation with local officials. Solution packages are to contain detailed operating instructions, equipment specifications, manuals, and other features which would permit the immediate application of sophisticated management and engineering techniques by the relatively unskilled staffs of small rural governments. GRA

N75-33919# National Environmental Research Center, Cincinnati, Ohio.
[DEVELOPMENTS IN POLLUTION CONTROL TECHNOLOGY] NERC 74 Annual Report
Mar. 1975 105 p
(PB-242040/4; EPA-670/9-75-002) Avail: NTIS HC $5.25

Research activities of each of the NERC-Cincinnati laboratories are summarized, and a number of contributions made by the staff members to international activities of EPA are highlighted. Certain projects from the research activities have been chosen for special mention. It is indicated that FY 1974 has witnessed a significant step forward in the Cincinnati mission to develop pollution control technology in the areas of municipal and industrial waste treatment, municipal water supplies and systems, solid and hazardous waste disposal, pollution indentification methodology and monitoring, and toxicological health effects. GRA

N75-33920# Naval Research Lab., Washington, D.C.
PRINCIPLES OF THE CODASYL APPROACH TO THE DESCRIPTION OF DATA STRUCTURES Interim Report
Frank A. Manola Jun. 1975 30 p refs
(AD-A011034; NRL-MR-3068) Avail: NTIS CSCL 05/2

Interest in the subject of data bases and data base management systems has been growing in the past several years at a rapidly accelerating rate both on the part of computer scientists and on the part of managers and data processing personnel in user organizations. Much of this interest has been stimulated by the existence of the language specifications published in the April 1971 report of the CODASYL (Conference On Data Systems Languages) Data Base Task Group (DBTG). These specifications included two data description languages and one data manipulation language, as well as a proposed data base system architecture in which these languages would be used. The specifications were written with a certain background and a specific method of specifying data and data relationships in mind. It is the purpose of this paper to outline some of this background and some of the principles on which these language specifications were based. In particular, the paper concentrates on the underlying philosophy of describing data and its structure embodied in what has come to be known as the network model of data. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N75-33921# Peat, Marwick, Mitchell and Co., Washington, D.C.
R AND D INCENTIVES STUDY. VOLUME 1: PROJECT Final Report
Allan Taubi Apr. 1974 85 p
(Contract NSF C-825)
(PB-242254/1; NSF/RA/R-74-013-A-Vol-1) Avail: NTIS HC $4.75 CSCL 05C

The effects are investigated of federal tax policies on private investments in research and development. The advantages of providing incentives through alternative policies were examined. Six tax policies were developed and six candidate industries were selected on which to test their effects. The concept and design of an experimental program within which the alternative tax policies might be tested are described. GRA

N75-33922# Peat, Marwick, Mitchell and Co., Washington, D.C.
R AND D INCENTIVES STUDY. VOLUME 2: EXPERIMENTAL PROGRAM CONCEPT AND DESIGN Final Report
Allan Taub Apr. 1974 50 p refs
(Contract NSF C-825)
(PB-242255/8; NSF/RA/R-74-013-B-Vol-2) Avail: NTIS HC $3.75 CSCL 05C

For abstract, see N75-33921.

N75-33923# Kentucky Univ., Lexington. Dept. of Statistics.
THE SECRETARY PROBLEM: OPTIMAL SELECTION WITH INTERVIEW COST
Z. Govindarajulu Jan. 1975 22 p refs

(Contract N00014-73-A-0385-0001; NR Proj. 042-295)
(AD-A010192; TR-82) Avail: NTIS CSCL 12/2

The results of Chow, Moriguti, Robbins and Samuels (CMRS) (1964) for the secretary problem have been extended to the case with interview costs. Certain tables for chosen cost functions and certain n(n denotes the total number of candidates) have been provided illustrating the optimal rule and the optimal expected pay-off. A couple of approximations which involve solving differential equations are also given. Next is considered the secretary problem when one can recall the immediately preceding candidate. The optimal rule is derived and is illustrated for certain cost functions and a few chosen values of n. The approximating differential equations are obtained. The solution to the problem with zero interview cost is obtained. GRA

N75-33924# Defense Documentation Center, Alexandria, Va.
COST EFFECTIVENESS ANALYSIS Report Bibliography, Jul. 1973 - Dec. 1974
May 1975 329 p refs
(AD-A010400; DDC-TAS-75) Avail: NTIS CSCL 14/1

Cost effectiveness in this bibliography relates to program evaluations, management techniques and problems, research and development, decision making, design tradeoffs, related cost analysis and methodology, and systems value engineering. This bibliography represents a collection of unclassified-unlimited citations in the Defense Documentation Center's data bank that have been cataloged since June 1973. Four computer-generated indexes of Corporate Author-Monitoring Agency, Subject, Title, and Personal Author are provided. GRA

N75-33925# California Univ., Berkeley. Operations Research Center.
ON HOMOTHETIC SCALAR VALUED PRODUCTION FUNCTIONS
Rolf Fare and Ronald W. Sheppard Apr. 1975 9 p refs Prepared in cooperation with Lund Univ.
(Contract N00014-69-A-0200-1010; Grant NSF MPS-74-21222; NR Proj. 047-033)
(AD-A010139; ORC-75-4) Avail: NTIS CSCL 12/2

Seven equivalent statements of homotheticity are given for scalar valued production functions. These 7 statements relate to the functional form, the level sets L(u), the cost function, linearity of expansion paths and the distance function for the correspondence u maps to L(u). GRA

N75-33926# California Univ., Berkeley. Operations Research Center.
EFFICIENCY AND THE PRODUCTION FUNCTION
Rolf Fare Apr. 1975 17 p refs Prepared in cooperation with Lund Univ.
(Contract N00014-69-A-0200-1010; NR Proj. 047-033)
(AD-A010140; ORC-75-5) Avail: NTIS CSCL 05/3

A functional representation of the efficient subset of input vectors is given in this paper and it is used to characterize the technology. GRA

N75-33927# Assistant Secretary of Defense (Installations and Logistics), Washington, D.C.
GUIDE FOR MONITORING CONTRACTORS' INDIRECT COST
3 Jul. 1974 102 p
(AD-A009951) Avail: NTIS CSCL 05/1

This Guide is directed toward better control of the indirect costs, or overhead, particularly in those plants which perform major Government contracts. It does not relieve contractor management of its traditional responsibility to manage and control. It does point out what the Government expects of contractor management and how the Government would monitor their efforts. Effective control of indirect costs involves tests of reasonableness, allowability, and allocability. Of these, the tests of reasonableness relates both to the reasonableness of the dollar amount of a cost and to the reasonableness of the contractor's action in incurring the cost. It is essential that those tests be vigorously applied to all costs, including indirect costs which account for a very large portion of the procurement dollars. GRA

N75-33928# General Technical Services, Inc., Upper Darby, Pa.
OVERCOMING BARRIERS TO COMMERCIALIZATION OF INNOVATIVE TECHNOLOGY: REPORT OF WORKSHOP AT 1974 ANNUAL CONFERENCE OF THE AMERICAN ASSOCIATION OF SMALL RESEARCH COMPANIES Final Report
S. Z. Cardon Jan. 1974 15 p refs Workshop held at Washington D. C., 23 Jan. 1974
(Grant NSF DI-40611)
(PB-242191/5; NSF/RA/R-74-037) Avail: NTIS HC $3.25 CSCL 05A

The main function of the workshop was to rate the effectiveness (as perceived by the American Association of Small Research Companies members) of a number of potential Federal incentives aimed at stimulating increased technological innovation and new product exploitation in small high technology companies. These findings are summarized, the small research company is defined, and companies' needs relative to government support are discussed. GRA

N75-33929# Commerce Dept., Washington, D.C.
COMMERCE TODAY, VOLUME 5, NUMBER 18, JUNE 9, 1975
9 Jun. 1975 43 p
(COM-74-50944-18) Avail: NTIS MF $2.25; HC available from SOD CSCL 05C

Contents: large beef supply may ease upward pressure on consumer price index; government and business are working together to sharpen a marketing tool-statistics; consumer product safety act seen affecting business actions; incentive program pays technology bonus to American industry; energy management digest; domestic business report; international commerce report. GRA

N75-33930# Bureau of International Commerce, Washington, D.C. Office of International Marketing.
GLOBAL MARKET SURVEY: AVIONICS AND AVIATION SUPPORT EQUIPMENT
May 1975 190 p
(COM-75-50391/2) Avail: NTIS MF $2.25; HC available from SOD CSCL 05C

The global market survey is intended to serve as an export sales planning tool for marketing decision makers of American companies engaged in the manufacture of avionics and aviation support equipment. It is a ready desk reference of facts and figures on the country markets researched and identifies the best U.S. export sales opportunities in each market on a product-by-product basis. GRA

N75-33931# Center for Naval Analyses, Arlington, Va. Warfare Analysis Group.
THE ECONOMIC IMPACT OF AN INTERRUPTION IN UNITED STATES PETROLEUM IMPORTS: 1975 - 2000
Randall G. Holcombe Nov. 1974 112 p refs
(Contract N00014-68-A-0091)
(AD-A010914; NWAG-Research-Contrib-245) Avail: NTIS CSCL 05/3

The objective of this paper is to estimate the economic impact of a possible interruption in petroleum imports during the period from 1975 to the year 2000. It begins by incorporating the data of the recent oil embargo into an input-output model of the U.S. economy, in order to assess the economic impact of the interruption in imports. The model will be used as a framework for estimating the impact of all sizes of oil import interruptions, from small interruptions to a complete cutoff of imports. Several different scenarios of petroleum supply and demand are developed; indicating the uncertainties in our energy future, but also reflecting the fact that there are many policy options that can be chosen in order to encourage -- and discourage -self-sufficiency in energy. GRA

N75-33932# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
THE ECONOMICS OF THE NATURAL GAS SHORTAGE (1960-1980)
Paul W. MacAvoy and Robert S. Pindyck Sep. 1974 264 p refs
(Grant NSF GI-34936)
(PB-242166/7; MIT-EL-74-011; NSF/RA/N-74-204) Avail:

NTIS HC $8.50 CSCL 21D

An econometric policy model of the natural gas industry is described. The structure of the model is given in detail, as is the estimation of the model's equations. The model is then used in a variety of policy simulations to analyze the past and probable future behavior of the natural gas industry under alternative FPC regulatory policies. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N75-33933# Committee of Conference (U. S. Congress).
MAKING APPROPRIATIONS FOR THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, AND FOR SUNDRY INDEPENDENT EXECUTIVE AGENCIES FOR THE FISCAL YEAR ENDING 30 JUNE 1976 AND THE PERIOD ENDING 30 SEPTEMBER 1976
Washington GPO 23 Sep. 1975 15 p Rept. to accompany H.R. 8070, 94th Congr., 1st Sess., 23 Sep. 1975
(H-Rept-94-502) Avail: US Capitol, Senate Document Room

Appropriations for the emergency homeowner's relief fund and for independent agencies are discussed. Changes in the appropriations to the Department of Housing and Urban Development are included. M.J.S.

N75-33934# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION INDEX, 1976, VOLUME 1; VOLUME 2, PARTS 1, 2, 3, 4; VOLUME 3
Washington GPO 1975 307 p Index for Hearings on H.R. 2931 (superseded by H.R. 4700) before Comm. on Sci. and Technol., 94th Congr., 1st Sess., 1975
(GPO-55-777) Avail: Comm. on Sci. and Technol.

An alphabetical index of personal names and subjects compiled for hearings before the Committee on Science and Technology of the U.S. House of Representatives was presented. Y.J.A.

N75-33935# Leibowitz (Arnold H.), Washington, D.C.
GOVERNMENT POLICY AND INNOVATION: THE SMALL BUSINESS ADMINISTRATION EXPERIENCE Final Report
Arnold Leibowitz Dec. 1974 94 p refs
(Grant NSF DI-40778)
(PB-242337/4; NSF/RA/R-74-065) Avail: NTIS HC $4.75 CSCL 05C

The development of the SBA from its beginnings in 1953 to the present is reviewed with a special emphasis on its support of technological innovation. Such support has included: (1) financial assistance in the form of direct loans, guaranteed loans, and indirect loan assistance through small business investment corporations; (2) efforts to assist small research and development firms in obtaining government contracts; and (3) a technological information program, begun in 1968, concerning developments in research and development. These activities are evaluated in detail and specific recommendations are made for further studies. GRA

N75-33936# British Steel Corp., Sheffield (England). British Steel Corp.
THE HUMAN FACTOR IN AUTOMATION
P. J. A. Ketteringham Apr. 1975 12 p refs
(PB-242506/4; BISRA-CEL/CF/3/75) Avail: NTIS HC $3.25 CSCL 05C

As the level of automation of the iron and steel industry's manufacturing processes increases, the role of the human operator becomes more, and not less, critical. If overall man-machine system performance is to reach expected levels then more consideration needs to be given to the operator's eventual role. Possible solutions to this increasingly important problem lie, in the short term, in adoption of an effective system design approach which can be enhanced, in the longer term, by research. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N75-33937* National Aeronautics and Space Administration, Washington, D.C.
PRODUCTION TO START ON NEW FIREFIGHTER'S BREATHING SYSTEM
9 Sep. 1975 4 p
(NASA-News-Release-75-250) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8756, Baltimore/Washington International Airport, Md. 21240 CSCL 05A

Production of a lightweight firefighter's breathing system based on concepts and hardware developed by NASA engineers from aerospace technology is discussed. Author

N75-33938* National Aeronautics and Space Administration, Washington, D.C.
REMARKS OF RUTH BATES HARRIS, DEPUTY ASSISTANT ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AT SUMMER INSTITUTE CLOSING ACTIVITY
15 Sep. 1975 12 p
(NASA-News-Release-75-239) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8756, Baltimore/Washington International Airport, Md. 21240 CSCL 05A

Applications of experience and knowledge gained from aeronautical and space research and exploration are discussed briefly. Spinoffs are presented which improve the quality of life by contributing to advances in health, transportation, foods, communications, energy, safety, and manufacturing. M.J.S.

N75-33939*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
THE URBAN GEOGRAPHICAL SURVEY
J. P. Sabatier Washington NASA Aug. 1975 53 p refs Transl. into ENGLISH of "Le Repertoire Geographique Urbain", Rept. Rept-80/RCU Inst. Natl. de la Statistique et des Etudes Economiques, Marseille, France, Feb. 1974 p 1-49
(Contract NASw-2789)
(NASA-TT-F-16494; Rept-80/RCU) Avail: NTIS HC $4.25 CSCL 08B

The UGS, the urban geographic survey, which is a demographic study entailing geocodification in its many forms and systems, is dealt with. The survey concerns itself with computerized data processing to facilitate speedy location of identifying reference points in the case of blocks, block frontages, street segments and in the numbering of the latter by the use of coordinates, and automatic cartographic generations. It also researches pedestrian and traffic patterns. Author

N75-33940*# Norfolk State Coll., Va.
TIDEWATER METROPOLITAN AREA TRANSPORTATION SURVEY STUDY
John C. Ficht [1975] 30 p refs
(Grant NsG-1145)
(NASA-CR-132750) Avail: NTIS HC $3.75 CSCL 13F

Results of a survey conducted in southeastern Virginia to identify public opinion regarding requirements for future public transportation are analyzed. The effects of age and income level on attitudes concerning city living and no importance of various characteristics described for urban transportation systems are identified. Author

N75-33941# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
HIGH SPEED GROUND TRANSPORTATION WITH MAGNETIC LEVITATION TECHNIQUES. VOLUME 1: SYSTEMS CONCEPTS [SPURGEBUNDENER SCHNELLVERKEHR MIT BERUEHRUNGSFREIER FAHRTECHNIK. BAND 1: SYSTEMKONZEPTE]

Dec. 1974 206 p refs In GERMAN; ENGLISH summary Proc. of the 3d Statusseminar, Berlin, 18-21 Mar. 1974
(BMFT-FB-T-74-38) Avail: NTIS HC $7.25; ZLDI, Munich DM 43,30

The state-of-the-art of experimentation in test facilities is summarized. Theoretical assumptions and practical results are compared. Topics discussed include support and guidance systems, propulsion methods (linear induction motor), the track (concrete and/or steel track), and power pick-up. ESA

N75-33942# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
HIGH SPEED GROUND TRANSPORTATION WITH MAGNETIC LEVITATION TECHNIQUES. VOLUME 3: TRACKS, SUPPORTS AND GUIDANCE, SECURITY AND RELIABILITY [SPURGEBUNDENER SCHNELLVERKEHR MIT BERUEHRUNGSFREIER FAHRTECHNIK. BAND 3: FAHRBAHNEN, TRAGEN UND FUEHREN, SICHERHEIT, ZUVERLAESSIGKEIT]
Dec. 1974 226 p refs In GERMAN; ENGLISH summary Proc. of the 3d Statusseminar, Berlin, 18-21 Mar. 1974
(BMFT-FB-T-74-40) Avail: NTIS HC $7.50; ZLDI, Munich DM 47,70

Results of high speed ground transportation development are summarized. Magnetic levitation achieved with electromagnetic or electrodynamic systems is at present tested simultaneously. Emphasis of component development is on tracks supports (concrete and/or steel tracks), guidance system, and safety and reliability aspects. ESA

N75-33943# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
COST STRUCTURE OF TUBE VEHICLE SYSTEM FOR HIGH SPEED GROUND TRANSPORTATION
P. M. Bunting, Z. A. Gralewski, and N. M. Hawkins Jul. 1975 88 p refs Sponsored by Sci. Res. Council
(TT-7510) Avail: NTIS HC $4.75

The cost for a system having a hypothetical length of 400km and a single intermediate station were estimated. A range of tunnel/tube diameters were considered in order to examine the tradeoff between construction costs and costs associated with aerodynamic drag. A range of construction costs was adopted, reflecting differing tunnel costs and land costs. Interest was charged at 10% and 15% per annum. A range of concise speed (50 m/sec to 130 m/sec) was considered. The variability of the costs with respect to cruise speed shown is the result of assuming a fixed level of evacuation (90% of the air removed) for all speeds. Approximate estimates of seating capacity were made, and total annual costs were computed, together with unit costs. ESA

N75-33944# American Public Works Association, Chicago, Ill.
DYNAMIC TECHNOLOGY TRANSFER AND UTILIZATION: THE KEY TO PROGRESSIVE PUBLIC WORKS MANAGEMENT Final Report
Morris M. Cohn and M. J. Manning Nov. 1974 88 p refs
(Contract NSF DI-38422)
(PB-242193/1; APWA-1974; NSF/RA/R-74-031) Avail: NTIS HC $4.75 CSCL 05A

New roles are proposed for professional public works associations and for APWA in particular within the technology transfer processes of research, development, production, dissemination, and application. The thrust of these roles is to assure satisfactory monitoring, evaluation, and assistance to help identify and satisfy technology needs in the public works field. GRA

N75-33945# Arizona Univ., Tucson. Dept. of Electrical Engineering.
APPLICATION OF SPECIFIC MILITARY/SPACE DEVELOPMENT TO THE PUBLIC SECTOR Annual Report
Stuart A. Hoeing Jun. 1974 66 p refs
(Grant NSF DI-039554)
(PB-242330/9; NAS/RA/R-74-030) Avail: NTIS HC $4.25 CSCL 14B

This interim report describes a potential experiment in cooperative research involving a university and an industry, whereby limited government cost-sharing is used as an incentive for establishing a long term cooperative program. It describes the steps taken by the author in attempting to establish the cooperative program with industrial organizations. Barriers encountered, steps taken to overcome the barriers, and conditions necessary to induce industrial participation in the program are outlined. The research discussed includes monitoring of mine hoist cables, excelectron technology, electrostatic dust control, and methane production from sewage. GRA

N75-33946# Harbridge House, Inc., Boston, Mass.
LEGAL INCENTIVES AND BARRIERS TO UTILIZING TECHNOLOGICAL INNOVATION. REFERENCE EDITION Final Report
Richard I. Miller Mar. 1974 203 p refs
(Contract NSF C-822)
(PB-242194/9; NSF/RA/R-74-004; NSF/RDI-4) Avail: NTIS HC $7.25 CSCL 05A

The entire body of law which affects the commercial development of technological innovation on its way to the marketplace is examined. The research included in-depth studies of specific court cases, interviews, surveys, reviews of licensing policies and practices, and examinations of trade secret case data in six major industrial states and the FTC. GRA

N75-33947# Syracuse Univ. Research Corp., N.Y.
FEDERAL LABORATORIES AND TECHNOLOGY TRANSFER: INSTITUTIONS, LINKAGES, AND PROCESSES Final Report
Albert Teich and W. Henry Lambright Mar. 1974 347 p refs Prepared jointly with the State Univ. of New York, Syracuse
(Contract NSF C-832)
(PB-242225/1; NSF/RA/R-74-018; NSF/RDI-18) Avail: NTIS HC $9.50 CSCL 05A

The study placed special emphasis on the nature and development of linkages among the necessary participants involved in the transfer process, and is based on a conceptual model of technology transfer which assumes that there are three basic functions involved: innovation, manufacture, and utilization. The 11 cases studied were a silent communication alarm network, an electrical switchpack, an automated chemical analysis method, slippery water, a rechargeable cardiac pacemaker, an artificial kidney, an automated hospital room, firefighters protective clothing, a microwave landing system, and the synchronous communications satellite. GRA

N75-33948# Auburn Univ., Ala. Engineering Experiment Station.
SYSTEM DESIGN FOR LINKING RESEARCH AND TECHNOLOGICAL RESOURCES TO NEEDS OF STATE LEGISLATURES Final Report
J. Grady Cox and Gerald W. Johnson 28 Feb. 1974 105 p refs
(Grant NSF DI-39498)
(PB-242305/1; NSF/RA/R-74-029) Avail: NTIS HC $5.25 CSCL 05A

A study is described which investigated the possibilities of linking existing scientific and technological resources in the state of Alabama to the needs of the Alabama state legislature. Data was collected on the science and technology needs of the Alabama legislators, on the science and technology content of legislation proposed during the 1973 session of the Alabama legislature, and on existing science and technology resources in the state. The report contains an analysis and evaluation of this data, with conclusions and recommendations for a proposed system designed to link these needs and resources. The conclusions and recommendations are believed to be applicable to other state legislatures. GRA

N75-33949# Indiana Univ., Bloomington. School of Public and Environmental Affairs.
A BACKGROUND STUDY OF TECHNOLOGY UTILIZATION IN THE FIELD OF PUBLIC WORKS. VOLUME 1. SUMMARY Final Report
Ralph K. Jones, Martin J. Manning (Am. Public Works Assoc.), and Donald M. Goldenbaum Mar. 1974 62 p
(Grant NSF DI-38422)
(PB-242352/3; NSF/RA/R-74-047) Avail: NTIS HC $4.25 CSCL 05A

The objective of the study is to identify and analyze the problems faced by public works officials in bringing new or improved technology to bear on their operations, and to develop means by which a major professional association (the APWA) might help to overcome those problems. The problems of technology utilization were found to be systemic in nature, and a long-range action program was recommended to design and test a formal public works technology coordination system. This system would be designed to bridge the gap between existing public works and technology management systems, to provide liaison with other key organizations. GRA

N75-33950# Williams (Charles W.), Inc., Alexandria, Va.
FEDERAL TECHNICAL ASSISTANCE AND THE NSF RDI PROGRAM Final Report
Charles W. Williams, Jr. and Thomas H. Givens Jul. 1974 56 p Sponsored by NSF
(PB-242384/6; NSF/RA/R-74-036) Avail: NTIS HC $4.25 CSCL 05A

This report is primarily concerned with the intergovernmental aspects of technical assistance from the federal government, and ways in which federal agencies can improve the innovation process. A brief overview of present federal technical assistance activities is presented along with a conceptual outline for a strategic evaluation of these activities. The present NSF/RDI program and its potential relationships with federal technical assistance are described. Three basic alternatives open to the RDI program to increase the rate of innovation are: adopt a strategic policy evaluation for federal technical assistance; develop a program of natural experiments around technical assistance; or combine the work of these two alternatives to yield a strategic evaluation/natural experiment program. GRA

N75-33951# Oregon Univ., Eugene. College of Business Administration.
EXPERIMENTAL CENTER FOR THE ADVANCEMENT OF INVENTION AND INNOVATION, PHASE 1 Annual Report, 1 Jul. - 31 Dec. 1973
Gerald G. Udell Jun. 1974 19 p
(Grant NSF CG-00001)
(PB-242267/3; NSF/RA/R-74-012; AR-1) Avail: NTIS HC $3.25 CSCL 05C

The activities of the Center for Innovation and Invention at the University of Oregon during its initial year of operation under NSF funding are summarized. The effectiveness of government sponsored innovation centers on influencing the career choice of students towards entrepreneurship and innovation, and ultimately in stimulating increased technological innovation and new enterprise formation is examined. Procedures are described for (1) establishing the center within a university framework; (2) developing curriculum and staff; (3) establishing legal requirements; (4) eliciting student and community response; and (5) selecting, evaluating and developing new products and services and new enterprises as classroom and laboratory activities. GRA

N75-33952# Martin Marietta Labs., Baltimore, Md.
STUDY TO DETERMINE THE FEASIBILITY OF AN EXPERIMENT TO TRANSFER TECHNOLOGY TO THE CRUSHED STONE INDUSTRY
M. A. Ozol Jun. 1974 122 p refs
(Contract NSF C-826)
(PB-242153/5; MML-TR-74-26c; NSF/RA/R-74-040) Avail: NTIS HC $5.25 CSCL 05C

Results are presented of a study of the crushed stone industry in the U.S. The report examines advanced technology that might be applied to improving the industry's productivity, describes mechanisms for transferring technology to the industry, and outlines plans for an appropriate technology transfer experiment. The study includes a review of the literature on crushed stone and related mining and mineral technology, interviews with crushed stone operators, and visits to various laboratories; it provides an assessment of the National Crushed Stone Association as a technology transfer agent. The results of the study point to environmental, zoning, and related problems as potential barriers to future productivity, and emphasize technological solutions that would permit higher levels of productivity without compromising environmental quality. GRA

N75-33953# Pennsylvania State Univ., University Park. Center for the Study of Science Policy.
DIFFUSION OF TECHNOLOGY IN STATE MISSION-ORIENTED AGENCIES Final Summary Report
Irwin Feller Dec. 1974 82 p refs
(Grant NSF DA-39596)
(PB-242549/4; NSF/RDA-73-24-2) Avail: NTIS HC $4.75 CSCL 05A

The results of an exploratory study that investigated the diffusion of technological innovations in the public sector are summarized. In particular, a description is given of the pattern of adoption of two technologies in each of two functional areas of state government in all fifty states. A computed measure of adoption for each of these technologies to a set of hypothesized independent variables in ten states, is given. GRA

N75-33954# Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.
FIELD STUDIES OF THE TECHNOLOGICAL INNOVATION PROCESS: EXECUTIVE SUMMARY Final Summary Report
Albert H. Rubenstein, Alok Chakrabarti, and Robert D. OKeefe 15 Sep. 1974 30 p
(Grant NSF DA-39470)
(PB-242748/2; NSF/RDA-73-27-2) Avail: NTIS HC $3.75 CSCL 05A

Field studies were carried out in 10 industrial organizations on factors that were perceived to significantly affect the research and development/innovation (RD/I) process. Such factors include both barriers and facilitators in the RD/I process. An initial list, in the form of propositions and variables of more than 200 such factors was developed from these sources: the empirical literature on the RD/I process; Northwestern University research on this subject, involving field research in more than 1,000 organizations over a 20 year period; and the insights of participants in and observers of the RD/I process. GRA

N75-33955# Environmental Protection Agency, Washington, D.C. Office of Research and Development.
FEDERAL SURFACE VEHICLE NOISE RESEARCH, DEVELOPMENT, AND DEMONSTRATION PROGRAMS: FY 1973 - FY 1975 Final Report
Mar. 1975 96 p refs
(PB-241887/9; EPA-600/2-75-002) Avail: NTIS HC $4.75 CSCL 13F

The Interagency Surface Vehicle Noise Research Panel was established to aid EPA in coordinating Federal noise research activities. The Federal agencies which sponsor and/or conduct the major portion of the surface vehicle noise RD&D are represented. They are the Department of Transportation, the Department of Commerce/National Bureau of Standards, the Department of Defense, and the EPA. Other agencies which sponsor surface vehicle noise research are the Department of Agriculture and the National Science Foundation. The report contains brief descriptions and fiscal data for the agencies' programs. Emphasis is on fiscal years 1973 through 1975. Also included are references and bibliographies of reports and publications which have resulted from the Federal surface vehicle RD&D activities. GRA

N75-33956# Sperry Urban Science Center, Washington, D.C.
INTER-PLAN COMMUNICATION AND MOTIVATION STUDY Final Report
Thomas E. Garrigan Nov. 1973 196 p
(Contract NSF C-799)
(PB-242181/6; Pub-GL-2000-1047; NSF/RA/R-73-033) Avail: NTIS HC $7.00 CSCL 13B

A six-month study was conducted in the Tampa Bay region and the state capital of Florida which investigated potential factors which diminished the success of innovative public programs, and which inhibited private investment in the development of solutions to public sector problems. Five major public programs were studied and discussed with over 50 key private and public decision-makers. It was concluded that innovative public programs

and the degree of private sector participation in them are adversely affected by several lacks which are discussed. GRA

N75-33957# Massachusetts Inst. of Tech., Cambridge.
PROCEEDINGS OF THE MIT SYMPOSIUM ON STRATEGIES FOR AID PROGRAMS IN SELECTED AREAS OF SCIENCE AND TECHNOLOGY. VOLUME 1: SUMMARY
J. P. Ruina, ed. Apr. 1974 62 p Conf. held at Cambridge, Mass., Apr. 1974 4 Vol.
(Contract AID/TA-1067)
(PB-242402/6) Avail: NTIS HC $4.25 CSCL 05A

The scope, balance, and perspective of the TA/OST program were examined within the context of current needs and conditions in developing nations. Topics considered include: construction, transportation, housing, water resources, and nutrition. GRA

N75-33958# Massachusetts Inst. of Tech., Cambridge.
PROCEEDINGS OF THE MIT SYMPOSIUM ON STRATEGIES FOR AID PROGRAMS IN SELECTED AREAS OF SCIENCE AND TECHNOLOGY. VOLUME 2. HOUSING, TRANSPORTATION AND WATER RESOURCES
J. P. Ruina, ed. Apr. 1974 164 p refs Conf. held at Cambridge, Mass., Apr. 1974 4 Vol.
(Contract AID/TA-1067)
(PB-242403/4) Avail: NTIS HC $6.25 CSCL 05A

For abstract, see N75-33957.

N75-33959# Massachusetts Inst. of Tech., Cambridge.
PROCEEDINGS ON THE MIT SYMPOSIUM OF STRATEGIES FOR AID PROGRAMS IN SELECTED AREAS OF SCIENCE AND TECHNOLOGY. VOLUME 3: CONSTRUCTION
Fred Moavenzadeh and Janet Ann Koch Rossow Apr. 1974 375 p refs Conf. held at Cambridge, Mass., Apr. 1974 4 Vol.
(Contract AID/TA-1067)
(PB-242404/2) Avail: NTIS HC $10.00 CSCL 13M

A state-of-the-art review is presented of the construction industry in the developing countries. The role of construction in the process of development and its importance to economic growth, employment creation, and income generation and re-distribution are discussed. Multi-national construction firms are reviewed as a potential means for the transfer, adaptation, and development of appropriate technologies to less industrialized countries. Opportunities available to the developing countries for using the multi-nationals as a vehicle for the developmental process and possible incentives for such use are also discussed. GRA

N75-33960# Massachusetts Inst. of Tech., Cambridge.
PROCEEDINGS OF THE MIT SYMPOSIUM ON STRATEGIES FOR AID PROGRAMS IN SELECTED AREAS OF SCIENCE AND TECHNOLOGY. VOLUME 4: FOOD TECHNOLOGY
J. P. Ruina Apr. 1974 31 p refs Conf. held at Cambridge, Mass., Apr. 1974 4 Vol.
(Contract AID/TA-1067)
(PB-242405/9) Avail: NTIS HC $3.75 CSCL 06H

The processing, preservation, and manufacture of foods is examined in the context of technology transfer from industrialized countries to low-income countries. Emphasis is placed on increasing food supply and combatting malnutrition. GRA

N75-33112* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Design Section.
AUTOMATED PARKING GARAGE SYSTEM MODEL
Earl R. Collins, Jr. *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 9 p (For availability see N75-33086 24-12)
CSCL 13B

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N75-33961 Wesleyan Univ., Middletown, Conn.
DOUBLE STAR MASSES DETERMINED BY SYNCHRONOUS STELLAR AREA SCANNING Ph.D. Thesis
Bruce Atwood 1975 176 p
Avail: Univ. Microfilms Order No. 75-22096

A novel method for processing the signal from stellar area scanning is presented. The stellar image is scanned rapidly enough to freeze gross motion due to seeing and telescope guiding error. Each of these rapid scans is processed in real time to determine its median. The scans are then stored such that the medians are superposed. The resulting one dimensional intensity profiles are analyzed by doing a least squares fit to a reference profile. Synchronous area scanning does give a high signal to noise ratio on dim stars with much shorter observing times. Dissert. Abstr.

N75-33962 Harvard Univ., Cambridge, Mass.
KINEMATIC PHENOMENA IN THE INNER REGION OF M81 Ph.D. Thesis
Jean Warren Goad 1974 96 p
Avail: Univ. Microfilms Order No. 75-18080

A normal nearby spiral M81, is shown to be a galaxy of kinematical complexity. Previous observations of this galaxy are presented; discussions of the velocity field for the gas in the inner 100 (1.45 kpc), derived from spectrograms in the wavelength region around H alpha, are included. All of the plates were taken with the 2.1-meter telescope at Kitt Peak National Observatory. Dissert. Abstr.

N75-33963# Manchester Univ. (England). Dept. of Astronomy.
SCALED PHOTOGRAMMETRIC RESEARCH Scientific Report, 16 Sep. 1971 - 15 Sep. 1974
Zdenek Kopal and Michael Moutsoulas Apr. 1975 44 p refs
(Grant AF-AFOSR-2261-72; AF Proj. 8607)
(AD-A010047; Rept-72-2261-2; AFCRL-TR-75-0246) Avail: NTIS CSCL 03/1

Recently a number of reference points for selenodetic control were adopted internationally (Moutsoulas, 1974) with the recommendation that they should be included in future photogrammetric studies of the lunar surface. Details of the first 66 points of the system - i.e., points consisting of craters having a diameter larger than 8 km, and therefore detectable on most plates used so far in lunar photogrammetric studies - are given. The Blagg-Muller catalogue number is included in brackets after the crater name. Also presented is the distribution of the adopted 211 points on the Blagg-Muller maps, with the corresponding catalogue number. GRA

N75-33964# Naval Research Lab., Washington, D.C.
FAR-INFRARED PHOTOMETER SYSTEM FOR AIRBORNE INFRARED ASTRONOMY
K. Shivanandan, D. P. McNutt, M. Daehler, and R. D. Feldman 21 Apr. 1975 19 p refs
(RR0340642)
(AD-A010518; NRL-7879) Avail: NTIS CSCL 03/1

Laboratory photometric and spectral calibrations were performed for a gallium-doped germanium (Ge:Ga) and epitaxial gallium arsenide (GaAs) photo-conductive detector optimized at 100 and 285 micrometers respectively. They were flown in a photometer system aboard a NASA Lear jet for far-infrared astronomical observations, and a comparison of the sensitivities of the airborne flight measurements was made relative to the laboratory measurements. GRA

N75-33965*# Owens Valley Radio Observatory, Pasadena, Calif.
CO OBSERVATIONS OF THE EXPANDING ENVELOPE OF IRC PLUS 10216
T. B. H. Kuiper (JPL), G. R. Knapp, S. L. Knapp, and Robert L. Brown (Natl. Radio Astronomy Obs.) 1975 26 p refs
(Contracts NAS7-100; N00014-67-A-0094-0019; Grant NSF GP-30400)

(NASA-CR-119157; AD-A011098; Rept-1975-8) Avail: NTIS HC $3.75 CSCL 03/2

High-sensitivity emission profiles were observed for the transition of C12O16 and C13O16 towards IRC + or - 10216. It appears that the spherically symmetric uniform mass-outflow model proposed by Morris is necessary to describe the line profiles. The outflow appears to be slightly accelerated, having a velocity of 15 km/sec at the edges of the CO cloud, compared with 12 km/sec for the more centrally confined molecules. Author

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N75-33966 Cornell Univ., Ithaca, N.Y.
ON THE DYNAMICS OF INTERPLANETARY DUST GRAINS Ph.D. Thesis
Philippe Louis Lamy 1975 333 p
Avail: Univ. Microfilms Order No. 75-21561

The interaction of spherical grains of various materials whose radii lie in the micronic and submicronic range with the interplanetary medium is solved. This includes: (1) interaction with the solar radiation field which is solved using Mie scattering theory and taking into account the precise dependence of optical properties upon wavelength; (2) interaction with solar wind considering corpuscular tangential drag; and (3) interaction with the interplanetary magnetic field in terms of a diffusion or random walk through a series of electromagnetic scatterings. Numerical results for these interactions span in the entire solar system with elliptical orbits of grains of various materials and sizes and provide a clear global picture of dust grain interactions that includes grain dynamic considerations. Dissert. Abstr.

N75-33967 Princeton Univ., N.J.
COSMIC PRIMEVAL TURBULENCE Ph.D. Thesis
Kwing Lam Chan 1975 93 p
Avail: Univ. Microfilms Order No. 75-23187

Two fundamental problems in the theory of cosmic turbulence are discussed in this thesis. The first problem concerns the energy spectrum of the cosmic turbulence and its evolution prior to decoupling. The turbulent dissipation of energy is studied. Generalizing the conventional physical transfer theory of turbulence to the case of expanding cosmic turbulence, it is shown that the cosmic turbulence spectrum obeys Kolmogorov's Law in the inertial range. The results of a numerical computation confirm the theory. The second problem concerns the effect of turbulence dissipation on the spectrum of microwave background radiation. Energy transfers from decaying cosmic turbulence to electrons and photons are studied. Distortions of cosmic microwave background radiation spectrum resulting from turbulence energy input are calculated analytically and numerically. Dissert. Abstr.

N75-33968 Harvard Univ., Cambridge, Mass.
A STATISTICAL THEORY OF THE KIRKWOOD GAPS Ph.D. Thesis
William Edward Wiesel, Jr. 1974 178 p
Avail: Univ. Microfilms Order No. 75-18082

A statistical phase mixing theory is constructed of the motion of a large number of particles near a resonance on the restricted problem of three bodies. The Poincare theory of resonance motion is reviewed. The general theory of phase mixing for this dynamical system is developed, both in the osculating and the mean mean elements. It is demonstrated analytically that for the two-body problem, or for motion far from resonance, that no gap appears. The special case is considered of starting all bodies with zero eccentricity and find that there is a gap above and a peak below the exact resonance for first order resonances. After a brief digression on the D. Brouwer theory of the gaps, the general phase mixing theory is studied in the case of the 2:1, 3:1 and 5:2 resonances in the Sun-Jupiter system. The time averaged elements show clean gaps at resonance due to the topology of the transformations involved. Dissert. Abstr.

N75-33969*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEUTRAL COMPOSITION GRAVITY WAVES IN THE THERMOSPHERE OBSERVED BY ESRO 4
H. Trinks and H. G. Mayr Oct. 1975 20 p refs Submitted for publication
(NASA-TM-X-70989; X-621-75-254) Avail: NTIS HC $3.25 CSCL 03B

Neutral composition waves with a wave length of about 5000 km and a wave period of about 2.5 hours were observed by ESRO 4 in the altitude region of 250 km. The amplitudes are of the order of 25 percent for Ar, 15 percent for N2, and roughly 10 percent for He and O at 25 percent geographic latitude. The wave amplitudes are seen to decrease towards lower latitudes suggesting that the composition waves are launched by auroral sources. Simultaneous ground based ionosonde measurements of the F2 layer critical frequency at mid and low latitudes show a wave period consistent with the satellite observations. The theoretical investigation with a multi-component model shows that diffusion plays a major role in explaining these wave phenomena. The phase and amplitude relation between atmospheric constituents are sensitive to the altitude region in which energy is deposited thus suggesting that Joule heating or soft particle precipitation are the predominant energy sources. Author

N75-33970*# California Inst. of Tech., Pasadena.
INFRARED, X-RAY, AND XUV ASTROPHYSICS Semiannual Status Report, 1 Apr. - 30 Sep. 1975
30 Sep. 1975 22 p refs
(Grants NGL-05-002-207; NGL-05-002-007)
(NASA-CR-143633) Avail: NTIS HC $3.25 CSCL 03B

An observational program covering wavelengths from the near infrared to 1 millimeter is reviewed. The program of millimeter observations largely consisted of analyzing previous observations since the summer humidity was too high for new observations. Maps of millimeter emission from W3, Sgr B2, W49 and M42 were made. Five extragalactic sources were detected and are discussed. Energy distributions of several of the discrete sources at the Galactic Center were studied. A 5-year visual/infrared program on Markarian galaxies is discussed which showed the presence of both thermal and nonthermal infrared radiation sources and established correlations between the infrared sources and the emission line regions. The Nova Cygnus 1975, caught during its rise as well as subsequent dimming, is also discussed. Several other continuing programs are described, including studies of dark clouds and CO maser sources. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N75-33971 Rice Univ., Houston, Tex.
INERT GAS INVESTIGATIONS OF THE APOLLO 15 AND 17 LANDING SITES Ph.D. Thesis
Jimmie Lynn Jordan 1975 151 p
Avail: Univ. Microfilms Order No. 75-22026

Findings of the inert gas contents in size fractions of fines from the Apollo 15 and 17 sites are presented. The very low argon gas contents and lack of anticorrelation with grain diameter of fines suggests they are undersaturated with respect to solar wind irradiation. Evidence for heavily irradiated (with respect to cosmic rays) zones deep within or beneath the regolith exists at both Apollo 15 and 17 landing sites. This may in part explain the missing cosmic ray record. Observed Ar-40 Ar-36 ratios in trench fines may be the result of excavation of materials with high Ar-40/Ar-36 ratios during the Van Serg event. The low apparent K-40 Ar-40 ages of the Apollo 15 fines are interpreted to be the result of addition of young K-40-AR-40 age material from Autolycus and Aristillus, two large craters north of the site, to the older mare materials. Dissert. Abstr.

N75-33972 Rice Univ., Houston, Tex.
THE IONOSPHERE OF VENUS Ph.D. Thesis
Dixon Matlock Butler 1975 263 p
Avail: Univ. Microfilms Order No. 75-21999

The Venus dayside ionosphere model includes both photochemistry and vertical diffusion. Basic neutral atmosphere and temperature structure were obtained from models by Dickinson and Ridley. A comprehensive study of ion chemistry and diffusion processes used approximations for ion and electron temperature structures. The model accurately reproduces the location of electron density peaks and shows that large mixing ratios of He are not required to explain the Mariner 5 observations between 250 and 475 km. The effects of solar zenith angle and temperature are examined in trying to explain Mariner 10 results. It is concluded that the solar wind or some other mechanism outside the scope of the models must be considered in the region above the principal electron layer. A model of the nightside ionosphere which does not require a large abundance of light reactive ions is proposed.
Dissert. Abstr.

N75-33973 Kentucky Univ., Lexington.
PRECISION NEUTRON ACTIVATION ANALYSIS OF LUNAR AND GEOLOGICAL SAMPLES Ph.D. Thesis
Michael David Miller 1974 224 p
Avail: Univ. Microfilms Order No. 75-18498

Improvements were made to systems for the determination of O, Si, Al, Mg and Fe in lunar and geological samples by 14 MeV neutron activation analysis. Methods were developed for use of a 1 mg Cf-252 neutron source in the determination of Mn and Na in lunar samples. Interferences to all determination were considered. The Si and Fe interferences to the Al determination, the Al interference to the Mg determination, the Al interference to the Fe determination, and the Mg interference to the Mn determination were found to be serious enough to warrant correction. The P interference to the Si determination and the Mg and Al interferences to the Na determination were found to be marginal at the elemental composition levels common in lunar materials. The effects of geometric reproducibility, 14 MeV neutron flux instability, and dead time and pulse pile-up in the neutron monitor and counting systems were examined. A method of gamma-ray peak integration for use with NaI(Tl) spectra is presented.
Dissert. Abstr.

N75-33974*# Scientific Translation Service, Santa Barbara, Calif.
FEASIBILITY OF VIEWING THE VENUS SURFACE BY MEANS OF BISTATIC RADAR
A. G. Pavelyev, O. I. Yakovlev, S. S. Matyugov, A. I. Kucheryavenkov, and V. I. Kayevitser Washington NASA Oct. 1975 16 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedeniy, Radiofiz. (Gorki), v. 18, no. 6, 1975 p 816-823
(Contract NASw-2791)
(NASA-TT-F-16600) Avail: NTIS HC $3.25 CSCL 03C

The feasibility of viewing the Venus surface by the bistatic radar method, was analyzed. Radio waves radiated by an artificial satellite in Venus orbit would be reflected by Venus and received on earth. The influence of various restrictions and interference factors was evaluated. It is shown that the resolving capacity is determined by the potential of the bistatic radar. Although this method of Venus surface viewing is developed on the basis of radar concepts, the authors consider the method as radioholographic.
Author

N75-33975*# Naval Biomedical Research Lab., Oakland, Calif.
POSSIBILITY OF GROWTH OF AIRBORNE MICROBES IN THE JOVIAN ATMOSPHERE Quarterly Progress Report
R. L. Dimmick, H. Wolochow, and M. A. Chatigny 14 Oct. 1975 9 p refs
(NASA Order W-13450)
(NASA-CR-119149; QPR-2) Avail: NTIS HC $3.25 CSCL 03B

Efforts to show growth activity of anaerobic bacteria in aerosolized particles suspended in anaerobic gas (N2) are described. Evidence of spore generation in nitrogen was obtained. Results are discussed.
Author

N75-33976*# Kanner (Leo) Associates, Redwood City, Calif.
ESTIMATION OF THE DENSITY OF SURFACE LAYER MATERIAL OF THE MOON, MARS, AND VENUS
N. N. Krupenio Washington NASA Oct. 1975 47 p refs Transl. into ENGLISH from Russian Report PR-202, Moscow, USSR Acad. of Sci., Inst. of Space Res., 1975 50 p
(Contract NASw-2790)
(NASA-TT-F-16609; PR-202) Avail: NTIS HC $3.75 CSCL 03B

The results of radar determinations of soil density in the local regions of the Moon are compared with the results of measuring density by mechanical methods. The densities of the upper layers of the Moon, Mars, and Venus are compared and the depth of radio wave penetration into their soil is estimated.
Author

N75-33977*# Scientific Translation Service, Santa Barbara, Calif.
THE NEW FACE OF MARS
M. Ya. Marov Washington NASA Oct. 1975 20 p refs Transl. into ENGLISH from Priroda (USSR), no. 8, Aug. 1975 P 13-23
(Contract NASw-2791)
(NASA-TT-F-16581) Avail: NTIS HC $3.25 CSCL 03B

A rudimentry description of knowledge on Mars is presented along with a review of American and Soviet interpretations of NASA data on Mars. A brief description of Mars atmospheric data based on results of Mars-6 lander and other USSR Mars spacecraft, and a discussion of Mars geology, winds, magnetic field, history, trajectory parameters and biology are included.
Author

N75-33978*# Scientific Translation Service, Santa Barbara, Calif.
THE MOON: 15 YEARS OF SPACE RESEARCH
V. V. Shevchenko Washington NASA Oct. 1975 19 p Transl. into ENGLISH from Zemlya Vselennaya, (USSR), no. 3, May - Jun. 1975 p 13-20
(Contract NASw-2791)
(NASA-TT-F-16584) Avail: NTIS HC $3.25 CSCL 03B

The history of earth-based and satellite exploration of the moon is presented. Both U.S. and Soviet lunar space programs are examined. Lunar soil composition, lunar formation, lunar history, lunar seismology, lunar maxons (excess mass concentrations), and lunar fields are described.
Author

N75-33979*# Kanner (Leo) Associates, Redwood City, Calif.
STELLAR WOUNDS OF THE EARTH AND THEIR DIAGNOSIS BY GEOPHYSICAL METHODS
A. I. Dabizha and V. V. Fedynskiy Washington NASA Oct. 1975 20 p Transl. into ENGLISH from Zemlya i Vselennaya (USSR), no. 3, May -Jun. 1975 p 56-64
(Contract NASw-2790)
(NASA-TT-F-16578) Avail: NTIS HC $3.25 CSCL 03B

The frequency of meteoritic craters on Earth is compared with the values for the Moon, Mars, Venus, and Mercury. Geophysical methods of detecting stellar wounds (astroblemes) are described. The mechanism of meteoritic shock action in scouring out craters is outlined. Amplitude of gravitational anomalies of an area suspected as covering the scars of a meteoritic impact is presented as a function of dimensions of meteoritic structures.
Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N75-33980 Arizona Univ., Tucson.
AN EXPERIMENTAL METHOD TO DETEMINE SMALL DIFFERENCES BETWEEN THE POLAR AND EQUATORIAL SOLAR LIMB PROFILES Ph.D. Thesis
Douglas Leonard Patz 1975 103 p
Avail: Univ. Microfilms Order No. 75-22385

The presence of an anisotropy can be determined by measuring the solar oblateness for different scan amplitudes of the solar image across the oblateness detector. Measurements of the solar oblateness for a scan amplitude of 54 arc sec were compared to previous oblateness measurements at a scan amplitude of 6.8 arc sec. Results indicate that the equator and poles of the sun have significantly different limb profiles near the extreme

edge of the limb. In this region the equatorial limb profile is brighter than the polar limb profile. The Finite Fourier Transform Definition (FFTD) was used in defining the edge of the observed solar limb and in eliminating the adverse effects of the atmospheric and instrumental transfer functions. Dissert. Abstr.

N75-33981 Wyoming Univ., Laramie.
A SPECTRAL ANALYSIS OF SOLAR SPICULES Ph.D. Thesis
Kenneth R. Krall 1975 154 p
Avail: Univ. Microfilms Order No. 75-22332

The spectral characteristics of solar limb spicules were investigated, using high dispersion emission spectra. The tower telescope and echelle spectrograph were used to obtain time sequences of simultaneous spectra in various wavelength regions using an entrance slit tangent to the solar disc. Through photometric reduction, total intensities, spicule diameters, Doppler velocities, and profile halfwidths were measured. Using intensity ratios and line widths, temperatures and electron densities were estimated. Corrections of the observations for atmospheric turbulence and variations in spectrograph slit heights are made. Halfwidths and Doppler shifts were found to vary in time similarly in H alpha and ionized calcium emission lines. Inclinations of spectral emission lines are probably caused in varying degrees by velocity variations parallel and perpendicular to spicule axes, and by superposition of profiles of separate or multi-component structures. Dissert. Abstr.

N75-33982 Arizona Univ., Tucson.
SOLAR SUPERGRANULATION Ph.D. Thesis
Simon Peter Worden 1975 168 p
Avail: Univ. Microfilms Order No. 75-19576

A convective process originating some 10,000 km below the solar surface was studied. Several observations designed to study the process are examined. An alternate approach taken in understanding stellar convection was the study of the dMe stars. A discussion of observational results within the framework of solar and stellar convection zone-magnetic interactions is provided. Simultaneous velocity, magnetic field, and chromospheric emission network data were used to study the lifetimes, the vertical velocity flow, and the transport of magnetic fields associated with supergranulation. Horizontal magnetic field motions take two forms: (1) an apparent slow breakup of existing flux points; and (2) a rapid motion of flux following the emergence of new magnetic field. The latter may be associated with the formation of a new supergranule. Results are consistent with a generalized stellar model in which strong magnetic fields are shown to be generated deep within the star. Dissert. Abstr.

N75-33983*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ARE CLIMATOLOGICAL CORRELATIONS WITH THE HALE DOUBLE SUNSPOT CYCLE MEANINGFUL?
Richard A. Goldberg and John R. Herman (Radio Sci. Co., Lowell, Mass.) Sep. 1975 12 p refs Submitted for publication
(NASA-TM-X-70995; X-912-75-245) Avail: NTIS HC $3.25 CSCL 03B

A sunspot cycle which may have been subject to a predicted phase reversal between 1800 and 1880 A. D is discussed. Several climatological parameters normally correlated with this cycle are examined and do not exhibit a corresponding phase reversal during this period. It is proposed that this apparent discrepency can be resolved by suitable observations during the upcoming half decade. Author

N75-33984*# Harvard Coll. Observatory, Cambridge, Mass.
ROCKET SPECTROMETER FOR INVESTIGATION OF THE FAR ULTRAVIOLET SOLAR SPECTRUM Semiannual Status Report, 1 Jul. 1974 - 30 Jun. 1975
W. H. Parkinson, E. M. Reeves, and J. L. Kohl 30 Jun. 1974 49 p refs
(Grant NGR-22-007-202)
(NASA-CR-119089; SASR-9; SASR-10) Avail: NTIS HC $3.75 CSCL 03B

A rocket-borne Ebert spectrometer and telescope were used for analysis of the solar spectrum. The instrument was arranged in the high resolution line scanning mode. Selected emission lines between 1170 and 1640 A were scanned, and a complete wavelength scan was made from 1170 A to 1850 A. Accurate measurements were made of the line profiles of the He II lines at 1640 A, C IV lines at 1550 A, Si IV lines at 1400 A, C II lines at 1335 A, the N V lines at 1240 A, and the C III lines at 1175 A. Accurate intensity measurements of the quiet sun spectrum for wavelengths between 1174 A and 3220 A were obtained. Spectral resolution was better than 0.03 A over most of the range and spatial resolution was relatively low so that the observations are averaged over the chromospheric network. Plots of absolute intensity versus wave length were prepared for the full wavelength range of the observations. Author

N75-33985*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE LARGE-SCALE MAGNETIC FIELD IN THE SOLAR WIND
L. F. Burlaga and N. F. Ness Sep. 1975 24 p refs Submitted for publication
(NASA-TM-X-70983; X-692-75-242) Avail: NTIS HC $3.25 CSCL 03B

A large-scale, three dimensional magnetic field in the interplanetary medium with an expected classical spiral pattern to zeroth order is discussed. Systematic and random deviations which are expected are treated. The sector structure which should be evident at high latitudes is examined. Interplanetary streams are discussed as determining the patterns of magnetic field intensity. It was proposed that the large-scale spiral field can induce a meridional flow which might alter the field geometry somewhat. The nonuniformities caused by streams will probably significantly influence the motion of solar and galactic particles. It was concluded that knowledge of the 3-dimensional field and its dynamical effects can be obtained by in situ measurements by a probe which goes over the sun's poles. Diagrams of the magnetic fields are given. Author

N75-33986# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 368. PART 1: (PROMPT REPORTS). DATA FOR MARCH 1975 - FEBRUARY 1975. EXPLANATION OF DATA REPORTS ISSUED AS NUMBER 366 (SUPPLEMENT) FEBRUARY 1975
Hope I. Leighton Apr. 1975 107 p
(COM-75-50193-368-1; SGD-368-Pt-1; NOAA-75051204)
Avail: NTIS MF $2.25; HC available from Natl. Climatic Center, Attn: Publications. Federal Bldg., Asheville, N. C. 28801. Subscription $34.50/year includes Part 1 (Prompt Reports) and Part 2 (Comprehensive Reports); $18.00/year for either part. Annual supplement containing explanation is included. $1.40/copy for either part; $1.30 for extra issue

Predicted and observed solar and geophysical data for February and March 1975 are presented in tables and graphs. The data include sunspot numbers, solar flux, solar flares and their effects, magnetic storms, and SID effects. Author

N75-33987# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 368. PART 2: (COMPREHENSIVE REPORTS) DATA FOR OCTOBER 1974 - SEPTEMBER 1974 AND MISCELLANEA. EXPLANATION OF DATA REPORTS ISSUED AS NUMBER 366 (SUPPLEMENT) FEBRUARY 1975
Hope I. Leighton Apr. 1975 65 p refs
(COM-75-50193-368-2; SGD-368-Pt-2; NOAA-75051205)
Avail: NTIS MF $2.25; HC available from Natl. Climatic Center, Attn: Publication. Federal Bldg., Asheville, N. C. 28801. Subscription $34.50/year includes part 1 (prompt reports) and part 2 (comprehensive reports); $18.00/year for either part. Annual supplement containing explanation is included. $1.40/copy for either part; $1.30 for extra issue CSCL 03B

Predicted and observed solar and geophysical data for September and October 1974 are presented in tables and graphs. The data include sunspot numbers, solar flux, solar flares and their effects, magnetic storms, and SID effects. Author

N75-33988# California Univ., La Jolla.
CORRELATION OF SOLAR X-RAY BURSTS WITH OPTICAL, RADIO AND ENERGETIC PARTICLE PHENOMENA Final

Report, Aug. 1973 - Jul. 1974
Hugh H. Hudson and Laurence E. Peterson 8 Jan. 1975 8 p refs
(Contract F19628-74-C-0046; AF Proj. 7649)
(AD-A010039; AFCRL-TR-75-0065) Avail: NTIS CSCL 03/2

The OSO-7 data on solar X-ray bursts have been used in several studies of solar flares. These studies have emphasized the correlation between X-ray emissions and phenomena observed at other wavelengths. A study of flares occurring beyond the solar limb has helped to determine the vertical extent of flare X-ray emission. This investigation also showed that the hot X-ray plasma cools predominantly by conduction, lending support to theories in which H alpha and other optical emissions obtain energy in this fashion. Another study determined the basic parameters of hard X-ray spectra as a support for detailed comparison with solar microwave emission. GRA

N75-33989# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
AN ATLAS OF QUIET SUN RADIO FREQUENCY MEASUREMENTS MADE AT THE SAGAMORE HILL SOLAR RADIO OBSERVATORY, 1966 - 1974
John P. Castelli, William R. Barron, and Jules Aarons 10 Mar. 1975 133 p refs
(AF Proj. 4643)
(AD-A010040; AFCRL-TR-75-0132; AFCRL-SR-189) Avail: NTIS CSCL 03/2

An atlas of quiet sun discrete frequency radio measurements made each day at the Sagamore Hill Solar Radio Observatory of the Air Force Cambridge Research Laboratories is presented for the years 1966 through 1974. Several times since 1966, frequency coverage has been expanded to provide the present monitoring at nine frequencies between 245 and 35,000 MHz. Data are presented in tables as observed and corrected to a sun-earth distance of 1 AU. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N75-33990*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIGNIFICANCE OF MEDIUM ENERGY GAMMA RAY ASTRONOMY IN THE STUDY OF COSMIC RAYS
C. E. Fichtel, D. A. Kniffen, D. J. Thompson, G. F. Bignami, and C. Y. Cheung (Maryland Univ., College Park, Md.) Sep. 1975 28 p refs Submitted for publication
(NASA-TM-X-70988; X-662-75-246) Avail: NTIS HC $3.75 CSCL 03B

Medium energy (about 10 to 30 MeV) gamma ray astronomy provides information on the product of the galactic electron cosmic ray intensity and the galactic matter to which the electrons are dynamically coupled by the magnetic field. Because high energy (greater than 100 MeV) gamma ray astronomy provides analogous information for the nucleonic cosmic rays and the relevant matter, a comparison between high energy and medium energy gamma ray intensities provides a direct ratio of the cosmic ray electrons and nucleons throughout the galaxy. A calculation of gamma ray production by electron bremsstrahlung shows that: bremsstrahlung energy loss is probably not negligible over the lifetime of the electrons in the galaxy; and the approximate bremsstrahlung calculation often used previously overestimates the gamma ray intensity by about a factor of two. As a specific example, expected medium energy gamma ray intensities are calculated for the speral arm model. Author

N75-33991*# Stanford Univ., Calif.
SPECTROSCOPIC ANALYSIS OF SOLAR AND COSMIC X-RAY SPECTRA. 1: THE NATURE OF COSMIC X-RAY SPECTRA AND PROPOSED ANALYTICAL TECHNIQUES
A. B. C. Walker, Jr. May 1975 79 p refs Presented at Symp. on the Techniques of Solar and Cosmic X-ray Spectroscopy, Surrey, Engl., 22-23 May 1975 Submitted for publication
(Grants NsG-7099; NsG-2049)
(NASA-CR-119093; SU-IPR-628) Avail: NTIS HC $4.75 CSCL 03B

Techniques for the study of the solar corona are reviewed as an introduction to a discussion of modifications required for the study of cosmic sources. Spectroscopic analysis of individual sources and the interstellar medium is considered. The latter was studied via analysis of its effect on the spectra of selected individual sources. The effects of various characteristics of the ISM, including the presence of grains, molecules, and ionization, are first discussed, and the development of ISM models is described. The expected spectral structure of individual cosmic sources is then reviewed with emphasis on supernovae remnants and binary X-ray sources. The observational and analytical requirements imposed by the characteristics of these sources are identified, and prospects for the analysis of abundances and the study of physical parameters within them are assessed. Prospects for the spectroscopic study of other classes of X-ray sources are also discussed. Author

N75-33992*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE HER X-1 SPECTRUM: A MEASURE OF THE FIELD NEAR THE MAGNETIC POLES OF A NEUTRON STAR
E. A. Boldt, S. S. Holt, R. E. Rothschild, and P. J. Serlemitsos Sep. 1975 9 p refs Submitted for publication
(NASA-TM-X-70981; X-661-75-233) Avail: NTIS HC $3.25 CSCL 03B

The steep high energy cutoff observed in the spectrum for Her X-1 was analyzed in terms of the severely modified Thomson scattering that dominates the radiative transfer in a highly magnetized plasma near the surface of a neutron star. The data indicate a field of about 1013 G near the magnetic poles and the stopping of accreting matter by nuclear collisions in the neighboring plasma. Author

N75-33993# Lund Univ. (Sweden). Dept. of Physics.
THE IMPORTANCE OF NUCLEAR COLLISIONS IN A COUNTER DETECTOR TELESCOPE IN THE DETERMINATION OF THE CHARGE SPECTRUM OF THE IRON GROUP OF THE COSMIC RADIATION
Sten Lindstam Dec. 1974 32 p refs
(LUIP-CR-74-16) Avail: NTIS HC $3.75

The importance of nuclear collisions of cosmic ray particles in a counter detector telescope is studied by simple Monte Carlo techniques. Emphasis is placed on the charge region just below iron and the calculations are restricted to fully relativistic cosmic rays. It is found that it is difficult to avoid a blurring in the charge spectrum from nuclear collisions leading to considerable systematic errors in some abundance ratios. Author (ESA)

N75-33994# Lund Univ. (Sweden). Dept. of Physics.
PRELIMINARY RESULTS FROM MEASUREMENTS IN NUCLEAR EMULSIONS OF THE ISOTOPIC COMPOSITION OF COSMIC RAY NITROGEN AND OXYGEN
L. Jacobsson, G. Joensson, and K. Kristiansson Oct. 1974 10 p refs Presented at the Symp. on Meas. and Interpretation of the Isotopic Composition of Solar and Galactic Cosmic Rays, Durham, N. H., USA, 9 - 11 Oct. 1974 Sponsored by Swed. Nat. Sci. Res. Council
(LUIP-CR-74-17) Avail: NTIS HC $3.25

Determination of isotopic masses of nitrogen and oxygen were made in a small stack of nuclear emulsion exposed in a balloon flight from Fort Churchill, Canada, in June 1970, from relations between track width and residual range. The mass spectra are the spectra of stopping nuclei, and their mean energy falls in the range 200 to 400 MeV/nucleon. The main peak for oxygen consists of 0.16 nuclei with a small fraction of heavier nuclei. N-14 seems to be more abundant than N-15. ESA

N75-33995# National Oceanic and Atmospheric Administration, Boulder, Colo.
H-ALPHA SYNOPTIC CHARTS OF SOLAR ACTIVITY FOR THE PERIOD OF SKYLAB OBSERVATIONS, MAY 1973 - MARCH 1974
Patrick S. McIntosh Feb. 1975 38 p refs
(COM-75-50279-40; UAG-40; NOAA-75032409) Avail: NTIS

MF $2.25; paper copy avail. from Natl. Climatic Center, Federal Building. Attn: Publ., Ashville, N. C. 28801. $25.20/year, $0.56/copy this issue CSCL 03B

Special charts are presented of the slowly-varying large-scale features of chromospheric solar activity covering the period of the manned and unmanned Skylab observations, May 28, 1973 to February 3, 1974. The charts are based on once-daily standard H-alpha observations which have been interpreted in terms of large-scale magnetic field regions according to a technique previously described. The data are given on the synoptic time scale of a solar rotation. GRA

N75-33996# Owens Valley Radio Observatory, Pasadena, Calif.
OH AND H2O MASERS IN THE MONOCEROS-R2 MOLECULAR CLOUD
G. R. Knapp and Robert L. Brown 1975 20 p refs
(Contract N00014-67-A-0094-0019)
(AD-A011078; Rept-1975-7) Avail: NTIS CSCL 03/2

Emission from OH and H2O masers has been detected in the direction of the Monoceros-R2 molecular cloud. Only the 1612 and 1665 MHz OH lines are observed, and from the emission characteristics of the sources the authors conclude that they arise in different locations. Two velocity components of the 1665 MHz source are highly linearly polarized (about 100%). This result allows the determination of limits on the magnetic field strength in the emission region, 3 times 10 to the -6th --B-- 4 times 10 to the -4th Gauss, and to estimate its orientation. The relation of the maser emission to the embedded HII region and to the IR sources in this cloud is discussed. The Mon-R2 region is similar to the Orion nebula complex, and appears to represent a somewhat earlier stage of star formation. GRA

99 GENERAL

N75-33997# National Research Council of Canada, Ottawa (Ontario).
QUARTERLY BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT, 1 APRIL - 30 JUNE 1975
30 Jun. 1975 88 p refs
(DME/NAE-1975(2); ISSN-0047-9055) Avail: NTIS HC $4.75

Articles, abstracts, and reviews of ongoing projects are presented. Aerodynamics, flight, human factors engineering, computer modeling, hydraulics, marine dynamics, gas dynamics and materials science are among the areas considered. For individual titles, see N75-33998 through N75-34000.

N75-33998 National Research Council of Canada, Ottawa (Ontario). National Aeronautical Establishment.
LIFT **c02**
W. E. Laundry *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab., 1 Apr. - 30 Jun. 1975 30 Jun. 1975 p 1-10 refs (For availability see N75-33997 24-99)

Using only the three laws of Newton, the phenomenon of aerodynamic lift is explained. Also developed from this approach are the induced drag and the aspect-ratio correction for the lift-curve slope. Finally, it is shown that the explanations requiring airfoil camber and thickness to produce lift are inaccurate and unnecessary. Author

N75-33999 National Research Council of Canada, Ottawa (Ontario). Control Systems and Human Engineering Lab.
CIRCADIAN RHYTHM IN PERFORMANCE ON THE NRC STRESSALYSER **c54**
Leslie Buck and Ralph Leonardo *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab., 1 Apr. - 30 Jun. 1975 30 Jun. 1975 p 11-31 refs (For availability see N75-33997 24-99)

Human subjects followed schedules of self-administered tests on the NRC stressalyser over a period of three days. Performance varied systematically according to time of day of testing, with the circadian rhythm more evident for movement times than for reaction times. The rhythm of accuracy scores was out of phase with that for speed scores, with performance being slowest but most accurate early in the waking day. Author

N75-34000 National Research Council of Canada, Ottawa (Ontario). Analysis Lab.
INTERACTIVE COMPUTER MODELS OF INDUSTRIAL OPERATIONS **c60**
U. Graefe, L. K. Nenonen, and K. Strobele (Hatch, Associates, Toronto, Ontario) *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab., 1 Apr. - 30 Jun. 1975 30 Jun. 1975 p 33-43 refs (For availability see N75-33997 24-99)

A simulation approach is described which features on-line interaction with the model. This objective is achieved by the adaptation of the GASP discrete event simulation language for use on a hybrid computer, permitting simulation of mixed continuous and discrete processes normally found in industrial complexes. Using a special-purpose display unit, on-line simulation is permitted under operator control. An application of the approach to a copper smelter scheduling study is described briefly with emphasis on the interaction capabilities. Author

N75-34001# Aerospace Corp., El Segundo, Calif.
THE AEROSPACE CORPORATION SPACE SCIENCE REPORT TO COSPAR FOR CY 1974 Interim Report
George A. Paulikas 7 May 1975 18 p refs
(Contract F04701-74-C-0075)
(AD-A010597; TR-0075(5260-10)-5; SAMSO-TR-75-128)
Avail: NTIS HC $3.25 CSCL 03/2

The results obtained during 1974 by the space research program of The Aerospace Corporation are presented. Research projects dealing with the aurora, the magnetosphere, the earth's upper atmosphere as well as the solar corona are described. GRA

N75-33099* Chrysler Corp., Detroit, Mich. Defense Div.
DISPERSION DEVELOPMENT PROGRAM
D. J. Carlson, R. J. Lusardi, and W. H. Phillips *In* NASA. Kennedy Space Center 9th Aerospace Mech. Symp. 1974 13 p (For availability see N75-33086 24-12)
(Contract DAAA21-72-C-0030)
CSCL 16C

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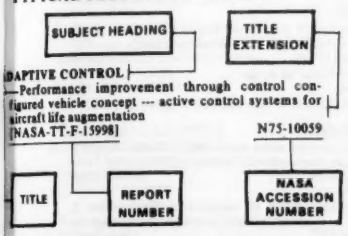

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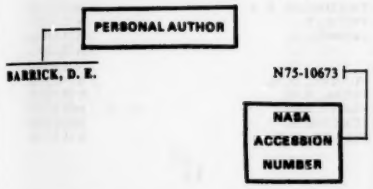

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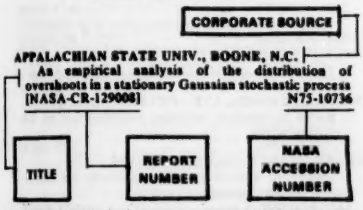

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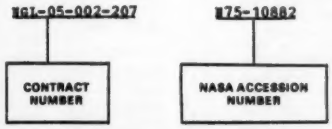

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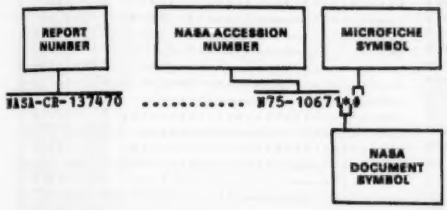

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AD-A010637	N75-33740 #
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AD-A010671	N75-33763 #
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AD-A011109	N75-33215 #
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AD-A011111	N75-33257 #
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AD-A011224	N75-33435 #
AD-A011247	N75-33381 #
AD-A011248	N75-33197 #
AD-A011249	N75-33488 #
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AD-A011458/7	N75-33291 #
AD-A011485/0	N75-33065 #
AD-A011488/4	N75-33067 #
AD-A011489/2	N75-33068 #
AD-A011563	N75-33521 #
AD-A011574	N75-33671 #
AD-A011584	N75-33356 #
AD-A011589	N75-33075 #
AD-A011593	N75-33796 #
AD-A011599	N75-33837 #
AD-A011601	N75-33236 #
AD-A011602	N75-33571 #
AD-A011603	N75-33329 #
AD-A011648	N75-33167 #
AD-A011681/8	N75-33290 #
AD-A012371/1	N75-33046 #
AD-A012372/9	N75-33047 #
AD-A012373/7	N75-33048 #
AD-A012374/5	N75-33049 #
AD-A012375/2	N75-33050 #
AD-A012383/6	N75-33006 #
AD-A012386/9	N75-33033 #
AD-A012387/7	N75-33043 #
AD-A012398/4	N75-33024 #
AD-A012496/6	N75-33017 #
AD-A012497/4	N75-33066 #
AD-A012965/0	N75-33660 #

AD-A012969/2 ..... N75-33034 #
AD-A013348/8 ..... N75-33288 #

ADL-C-77354 ..... N75-33534 #

AEDC-TR-74-129 ..... N75-33167 #

AFAL-TR-74-168-VOL-1 ..... N75-33037 #
AFAL-TR-74-168-VOL-2 ..... N75-33038 #
AFAL-TR-74-168-VOL-3 ..... N75-33039 #
AFAL-TR-74-168-VOL-4 ..... N75-33040 #
AFAL-TR-74-168-VOL-5 ..... N75-33041 #
AFAL-TR-75-88 ..... N75-33912 #

AFCEC-TR-75-8 ..... N75-33084 #

AFCRL-APSIG-305 ..... N75-33579 #

AFCRL-ERP-498 ..... N75-33577 #
AFCRL-ERP-500 ..... N75-33571 #

AFCRL-IP-227 ..... N75-33837 #

AFCRL-PSRP-620 ..... N75-33869 #
AFCRL-PSRP-621 ..... N75-33329 #
AFCRL-PSRP-624 ..... N75-33829 #
AFCRL-PSRP-625 ..... N75-33827 #
AFCRL-PSRP-629 ..... N75-33236 #

AFCRL-SR-189 ..... N75-33989 #

AFCRL-TR-74-0031 ..... N75-33844 #
AFCRL-TR-74-0139 ..... N75-33913 #
AFCRL-TR-74-0442 ..... N75-33874 #
AFCRL-TR-74-0642 ..... N75-33576 #
AFCRL-TR-75-0004 ..... N75-33869 #
AFCRL-TR-75-0011 ..... N75-33329 #
AFCRL-TR-75-0042 ..... N75-33577 #
AFCRL-TR-75-0053 ..... N75-33829 #
AFCRL-TR-75-0054 ..... N75-33827 #
AFCRL-TR-75-0065 ..... N75-33988 #
AFCRL-TR-75-0094 ..... N75-33867 #
AFCRL-TR-75-0132 ..... N75-33989 #
AFCRL-TR-75-0149 ..... N75-33571 #
AFCRL-TR-75-0158 ..... N75-33579 #
AFCRL-TR-75-0246 ..... N75-33963 #
AFCRL-TR-75-0272 ..... N75-33872 #
AFCRL-TR-75-0274 ..... N75-33842 #
AFCRL-TR-75-0275 ..... N75-33393 #
AFCRL-TR-75-0276 ..... N75-33841 #
AFCRL-TR-75-0277 ..... N75-33873 #
AFCRL-TR-75-0278 ..... N75-33871 #
AFCRL-TR-75-0281 ..... N75-33870 #
AFCRL-TR-75-0287 ..... N75-33200 #

AFHRL-TR-74-76 ..... N75-33076 #
AFHRL-TR-74-93 ..... N75-33891 #
AFHRL-TR-74-105 ..... N75-33672 #

AFML-TR-74-35 ..... N75-33189 #
AFML-TR-74-274 ..... N75-33886 #

AFOSR-75-0498TR ..... N75-33779 #
AFOSR-75-0500TR ..... N75-33778 #
AFOSR-75-0548TR ..... N75-33755 #
AFOSR-75-0615TR ..... N75-33391 #
AFOSR-75-0620TR ..... N75-33010 #
AFOSR-75-0646TR ..... N75-33771 #
AFOSR-75-0647TR ..... N75-33785 #
AFOSR-75-0670TR ..... N75-33331 #
AFOSR-75-0710TR ..... N75-33392 #
AFOSR-75-0711TR ..... N75-33815 #
AFOSR-75-0713TR ..... N75-33011 #
AFOSR-75-0715TR ..... N75-33028*#
AFOSR-75-0719TR ..... N75-33237 #
AFOSR-75-0781TR ..... N75-33436 #
AFOSR-75-0817TR ..... N75-33275 #

AFRPL-TR-75-13 ..... N75-33276 #

AFSWC-TR-75-42 ..... N75-33838 #

AFWL-TR-73-300 ..... N75-33740 #
AFWL-TR-74-152 ..... N75-33077 #
AFWL-TR-74-159-VOL-2 ..... N75-33916 #
AFWL-TR-74-177 ..... N75-33079 #
AFWL-TR-74-289 ..... N75-33066 #
AFWL-TR-74-15423 ..... N75-33075 #

AIRESEARCH-75-410939(6) ..... N75-33374*#

AMRL-TR-72-84 ..... N75-33671 #
AMRL-TR-74-125 ..... N75-33521 #

APWA-1974 ..... N75-33944 #

AR-1 ..... N75-33951 #

ARL-TR-75-23 ..... N75-33633 #

ARL-75-0094 ..... N75-33868 #
ARL-75-0095 ..... N75-33356 #
ARL-75-0101 ..... N75-33366 #
ARL-75-0103 ..... N75-33796 #

ARO-WKF-TR-74-100 ..... N75-33167 #

ARO-11944.3-EL ..... N75-33905 #
ARO-12215.4-E ..... N75-33748 #

AROSR-TR-75-0648 ..... N75-33782 #

ATC-45 ..... N75-33024 #
ATC-47 ..... N75-33292 #

ATR-74(7327)-1-VOL-2 ..... N75-33543 #

BBN-3060 ..... N75-33820 #

BISRA-CDL/ESD/6/74 ..... N75-33242 #
BISRA-CDL/MT/9/74 ..... N75-33244 #

BISRA-CEL/CF/3/75 ..... N75-33936 #

BISRA-GS/PROD/MISC/91/74/C ..... N75-33243 #
BISRA-GS/PROD/9/18/74/C ..... N75-33240 #

BISRA-SH/TH/A/380 ..... N75-33241 #
BISRA-SH/155/A ..... N75-33208 #
BISRA-SH/235/A ..... N75-33206 #
BISRA-SH/589/A ..... N75-33207 #
BISRA-SH/734/A ..... N75-33238 #

BM-OFR-43-75 ..... N75-33729 #
BM-OFR-44-75 ..... N75-33177 #

BM-RI-7938 ..... N75-33196 #
BM-RI-8040 ..... N75-33273 #

BMFT-FB-T-74-38 ..... N75-33941 #
BMFT-FB-T-74-40 ..... N75-33942 #

BNL-19688 ..... N75-33194 #

BRL-MR-2444 ..... N75-33254 #

BRL-1763 ..... N75-33074 #

BR44393 ..... N75-33747 #
BR44786 ..... N75-33569 #
BR44879 ..... N75-33625 #
BR44998 ..... N75-33175 #
BR46203 ..... N75-33272 #
BR46207 ..... N75-33297 #
BR46323 ..... N75-33327 #
BR46337 ..... N75-33151 #

BSR-4191 ..... N75-33475*#
BSR-4192 ..... N75-33475*#

CALT-822-67 ..... N75-33864 #
CALT-822-72 ..... N75-33863 #

CAM-100-22 ..... N75-33443 #

CASD-NAS-75-030 ..... N75-33726*#

CCL-P171 ..... N75-33378 #

CERL-TR-M-121 ..... N75-33435 #

CNES-NT-13 ..... N75-33731 #
CNES-NT-15 ..... N75-33296 #
CNES-NT-16 ..... N75-33173 #
CNES-NT-17 ..... N75-33814 #
CNES-NT-18 ..... N75-33174 #

COM-74-50458-04 ..... N75-33781 #
COM-74-50944-18 ..... N75-33929 #
COM-75-10617/9 ..... N75-33199 #
COM-75-10625/2 ..... N75-33198 #
COM-75-10631/0 ..... N75-33282 #
COM-75-10670/8 ..... N75-33626 #
COM-75-10685/6 ..... N75-33359 #
COM-75-10690/6 ..... N75-33439*#
COM-75-10691/4 ..... N75-33749 #
COM-75-10692/2 ..... N75-33285 #
COM-75-10696/3 ..... N75-33203 #
COM-75-10698/9 ..... N75-33883 #
COM-75-10729/2 ..... N75-33631 #
COM-75-10733/4 ..... N75-33580 #
COM-75-10739/1 ..... N75-33734 #
COM-75-10749/0 ..... N75-33507 #
COM-75-10751/6 ..... N75-33581 #
COM-75-10756/5 ..... N75-33204 #
COM-75-10763/1 ..... N75-33256 #
COM-75-10774/8 ..... N75-33758 #
COM-75-10784/7 ..... N75-33639 #
COM-75-10793/8 ..... N75-33308 #
COM-75-10817/5 ..... N75-33383*#
COM-75-10852/2 ..... N75-33616 #
COM-75-50141-06 ..... N75-33283 #
COM-75-50193-368-1 ..... N75-33986 #
COM-75-50193-368-2 ..... N75-33987 #
COM-75-50279-40 ..... N75-33995 #
COM-75-50391/2 ..... N75-33930 #

CONF-750463-1 ..... N75-33414 #
CONF-750617-1 ..... N75-33234 #
CONF-750617-5 ..... N75-33441 #

CONTRIB-118 ..... N75-33487 #
CONTRIB-149 ..... N75-33492 #
CONTRIB-3214 ..... N75-33176 #

COO-2152-15 ..... N75-33354 #
COO-2410-1 ..... N75-33388 #
COO-3632-27 ..... N75-33851 #

CRC-APRAC-CAPI-1-65-8 ..... N75-33529 #

CRC-472 ..... N75-33529 #

CRL-T-798 ..... N75-33667 #

CRREL-SR-227 ..... N75-33381 #
CRREL-SR-230 ..... N75-33488 #
CRREL-SR-231 ..... N75-33197 #

CSIR-CENG-068 ..... N75-33205 #

CSSP-3705-8 ..... N75-33507 #

DDC-TAS-75 ..... N75-33924 #

DGS-220 ..... N75-33576 #

DLR-FB-75-28 ..... N75-33008 #
DLR-FB-75-39 ..... N75-33007 #

DLR-MITT-75-06 ..... N75-33069 #

DM-15 ..... N75-33612 #

DME/NAE-1975(2) ..... N75-33997 #

DMS-AR-1022 ..... N75-33168 #

DMS-DR-2211-VOL-1 ..... N75-33162*#
DMS-DR-2211-VOL-2 ..... N75-33163*#
DMS-DR-2211-VOL-3 ..... N75-33164*#

DNA 3479F ..... N75-33281 #

DNA-3513T ..... N75-33583 #
DNA-3541T ..... N75-33159 #
DNA-3568F ..... N75-33825 #
DNA-3631F ..... N75-33914 #

DOC-74SD4265 ..... N75-33473*#

DOT-FR-20005-6 ..... N75-33545 #

DOT-HS-801414 ..... N75-33908 #

DOT-TSC-OST-75-11 ..... N75-33410 #
DOT-TSC-OST-75-16 ..... N75-33411 #

DOT-40176-6 ..... N75-33020 #

DR-223-VOL-4 ..... N75-33643 #

DRA-TR-73-01 ..... N75-33366 #

DREO-R-717 ..... N75-33214 #

DREO-TN-74-16 ..... N75-33490 #
DREO-TN-75-1 ..... N75-33512 #

DREV-4024/75 ..... N75-33224 #

D2-118561-1-VOL-1-APP-A ..... N75-33720*#
D2-118561-2-VOL-2-APP-B ..... N75-33721*#
D2-118561-3-VOL-3-APP-B ..... N75-33722*#
D2-118561-4-VOL-4-APP-C ..... N75-33723*#
D2-118561-5-VOL-5-APP-C ..... N75-33724*#
D2-118571-1-VOL-1 ..... N75-33673*#
D2-118571-2-VOL-2 ..... N75-33674*#
D3-9042-3 ..... N75-33034 #
D210-10953-1-VOL-1 ..... N75-33003*#
D210-10953-2-VOL-2 ..... N75-33004*#
D321-13008 ..... N75-33915 #

E-2641 ..... N75-33377*#
E-8272 ..... N75-33231*#
E-8305 ..... N75-33429*#
E-8354 ..... N75-33057*#
E-8358 ..... N75-33223*#
E-8393 ..... N75-33001*#
E-8440 ..... N75-33188*#
E-8469 ..... N75-33056*#
E-8483 ..... N75-33269*#
E-8496 ..... N75-33055*#
E-8497 ..... N75-33812*#
E-8502 ..... N75-33482*#

ECOM-4313 ..... N75-33839 #
ECOM-4323 ..... N75-33824 #

EERC-74-13 ..... N75-33080 #

EERL-74-24-VOL-1 ..... N75-33572 #
EERL-74-57-VOL-2 ..... N75-33573 #
EERL-74-86-VOL-3 ..... N75-33574 #
EERL-74-104 ..... N75-33575 #

EHL(K)-75-5 ..... N75-33251 #

EHL-H-74H-8 ..... N75-33549 #
EHL-H-74H-9 ..... N75-33058 #

ENVPREDRSCHF-TECH-NOTE-20 ..... N75-33617 #

ENVPREDRSCHF-TECH-PAPER-10-75 ..... N75-33615 #

EPA-430/9-75-008-VOL-1 ..... N75-33546 #
EPA-450/3-73-006-E-VOL-5 ..... N75-33532 #
EPA-450/3-75-052 ..... N75-33544 #
EPA-460/3-74-004-B ..... N75-33543 #
EPA-550/9-74-017 ..... N75-33548 #
EPA-550/9-75-022 ..... N75-33059 #
EPA-560/2-75-001 ..... N75-33534 #
EPA-600/2-75-002 ..... N75-33955 #
EPA-650/1-75-005 ..... N75-33527 #
EPA-650/2-74-126-B-VOL-2 ..... N75-33526 #
EPA-650/2-75-028 ..... N75-33538 #
EPA-650/2-75-032-B ..... N75-33503 #
EPA-650/3-74-008 ..... N75-33530 #
EPA-650/4-75-019 ..... N75-33536 #
EPA-650/4-75-021 ..... N75-33537 #
EPA-660/2-75-011 ..... N75-33491 #
EPA-670/2-75-056 ..... N75-33533 #
EPA-670/4-75-004-A-PT-1 ..... N75-33910 #
EPA-670/4-75-004-B-PT-2 ..... N75-33911 #
EPA-670/9-75-002 ..... N75-33919 #
EPA-906/9-75-001 ..... N75-33547 #

EPRI-RP74 ..... N75-33666 #

EPRI-SR-6 ..... N75-33833 #
EPRI-SR-7 ..... N75-33834 #

EPRI-280-FR ..... N75-33832 #

ERC-7396-S ..... N75-33510 #

ERDE-TR-177 ..... N75-33272 #

ERT-0412-F ..... N75-33479*#

ESA-CR(P)-665 ..... N75-33407 #
ESA-CR(P)-667 ..... N75-33143 #
ESA-CR(P)-668 ..... N75-33144 #
ESA-CR(P)-669 ..... N75-33145 #
ESA-CR(P)-675 ..... N75-33166 #

ESD-TR-74-289 ..... N75-33305 #
ESD-TR-75-57 ..... N75-33742 #
ESD-TR-75-61 ..... N75-33741 #
ESD-TR-75-165 ..... N75-33339 #

ESDU-75006 ..... N75-33427 +
ESDU-75011 ..... N75-33343 +
ESDU-75015 ..... N75-33887 +

ESL-P-592-PT-2 ..... N75-33028*#

ESL-4111-1 ..... N75-33333 #

ESN-29-5 ..... N75-33917 #

ESRO-CR(P)-514-VOL-1 ..... N75-33294 #
ESRO-CR(P)-515 ..... N75-33295 #
ESRO-CR(P)-649 ..... N75-33149 #
ESRO-CR(P)-650 ..... N75-33378 #
ESRO-CR(P)-653 ..... N75-33235 #
ESRO-CR(P)-655 ..... N75-33172 #

ESRO-ESTL-14 ..... N75-33235 #

ESRO-TN-123-ESTEC ..... N75-33326 #
ESRO-TN-124-ESTEC ..... N75-33165 #

ESS-3325-101-75 ..... N75-33489 #

ETL-CR-74-19 ..... N75-33489 #

E75-10395 ..... N75-33450*#
E75-10396 ..... N75-33451*#
E75-10397 ..... N75-33452*#
E75-10398 ..... N75-33453*#
E75-10399 ..... N75-33454*#
E75-10400 ..... N75-33455*#
E75-10401 ..... N75-33456*#
E75-10402 ..... N75-33457*#
E75-10403 ..... N75-33458*#
E75-10404 ..... N75-33459*#
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E75-10406 ..... N75-33461*#
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